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XIV.

A SYMPOSIUM ON STEPTOCOCCUS HEMOLYTICUS CARRIERS—CLINICAL ASPECT.*

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The rôle the tonsil plays in harboring infectious organisms has long been known, but its importance as a disseminator of disease has only been recently recognized, or at least apprecated. As a carrier of the diphtheritic bacillus it has been demonstrated that it has a very decided influence on the individual's social and economic value as far as the public health is concerned. But by its recognition as a carrier of the streptococcus as a secondary invader, its dangerous rôle has been greatly increased. It needed only a large assembling of men from all walks of life in the camps all over the country when the new army was being mobilized for 1917 for various acute infectious diseases to develop, especially scarlet fever and measles. It was the latter which more extensively prevailed,

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and you will all recall how frequently the sequelæ, laryngitis, bronchitis and pneumonia with empyema followed. The results were so serious as to cause great concern to the medical officers of the army, and alarm as far as the general public was concerned. The importance of this subject is shown by the manner in which it has been studied at the Base and General Hospitals, and by the reports of commissions appointed by the Surgeon-General to investigate it.

The variety of streptococcus that was the greatest factor in producing these serious complications was that known as the hemolyticus, an organism producing a lysis of the red blood corpuscles. The infection is secondary in character, and is ascending or descending; in the former, sinusitis, otitis media, and mastoiditis; and in the latter, laryngitis, bronchitis, pneumonia, and frequently empyema resulting. Cole and MacCallum[1] in studying the epidemic at Fort Sam Houston state in their report that the streptococcus hemolyticus was the chief cause of the bronchopneumonia following measles in that camp. This statement alone demonstrates the importance of the subject, and when the results from the investigations that are being made by some of the best observers in the army, both from the clinical and bacteriologic standpoint, and the data are all in, no doubt some definite plan will be formulated by which such serious epidemics in the army will be prevented or lessened in the future. What is true of the Army may apply equally in civil life, as to schools, factories and other places where large numbers of individuals are collected together. In this symposium we propose treating the subject of streptococcus carriers from the clinical, the bacteriologic and the epidemiologic standpoints.

The bacteriologic and clinical investigations were made by Lieut. Col. H. J. Nichols, M. C., U. S. A., Chief of the Laboratory Service, and myself, Chief of the Ear, Nose and Throat Section of the Surgical Service of the Walter Reed General Hospital, Takoma Park, D. C. Captain Blake will take up the epidemiologic side because of his general knowledge of the spread of this disease through the army. Those officers who were stationed at Base Hospitals probably had a better opportunity of studying this subject because of their little more intimate knowledge of the soldier from his incep-

tion in the camp. With us, our cases came into the hospital as patients from the various camps within a limited radius of Washington, such as Camps Meade, Lee, Leach, Meigs, Potomac Park, Humphreys, and from the office of the Attending Surgeon in Washington.

No doubt many of these cases entered the army from civil life as carriers. Levy and Alexander[2] in an examination of 489 new recruits from various sections of the country found 14.8 per cent carriers of the streptococcus hemolyticus. These findings are interesting and very instructive when compared with their further investigation made on troops after six months' service, all being apparently healthy men. Of ninety-five men from one company examined, seventy-nine, or 83.2 per cent, were carriers of streptococcus hemolyticus, 64.3 per cent being heavily infected. The inference is this increase in the disease was acquired in the hospital from the original carriers.

For the sake of comparison I am quoting from an earlier communication by Lieut. Col. H. J. Nichols and myself[3] showing the degree of the infection of the tonsils, of one hundred excised tonsils examined showed about 70 per cent markedly infected with hemolyticus streptococci. (These findings in excised tonsils will be seen to be very similar to those of Levy and Alexander's clinical findings.) It would have been interesting if we could have determined the evidence of streptococcus carriers in all patients immediately on their admission to the hospital, but this was not possible. The probabilities are that many of these cases entering the hospital for other than throat and nose conditions were carriers, and were only discovered after an indefinite stay. As soon as a patient became a suspect he was sent to the Ear, Nose and Throat Section for investigation.

The method of procedure was as soon as the patient presented himself at the Clinic a thorough examination was made of the upper air passages, and a culture by means of a swab was taken from the pharynx, the tonsils, saliva and anterior nares. These cultures were immediately sent to the laboratory and if the report returned was positive the patient was sent to the isolation ward, which was set apart especially for the care of all streptococcus cases.

The isolation of all carriers was strictly carried out, no one from outside was permitted to enter this ward save the medical officers, nurses and corps men assigned to the care of these cases.

Clinically these patients presented the usual variety of throat and nose disorders found in the average clinic. The tonsils were either hypertrophied with follicular degeneration, small and degenerated, or submerged.

The presence of the streptococcus organism can only be determined by a bacteriologic examination.

Various local methods were thoroughly tried out by Captain Wm. H. Huntington who was in charge of this ward until September 1st, 1918, and subsequently by Lieut. S. A. Alexander, to render the throats of these carriers negative, but they were found to be futile.

We divided the cases into five groups for treatment and observation. Group one received no treatment; group two received a hot alcohol gargle (20 per cent in water) every four hours during the day, group three received a hot Dobell's solution gargle every four hours during the day, group four received an application of a 5 per cent solution of dichloramine T, in chlorocosane to the face of the tonsil every four hours daily, group five received an application of a 25 per cent solution of nitrate of silver every four hours. These cases were all discharged after two successive negative cultures were obtained on separate days.

The result of this preliminary study is shown in Table I.

TABLE I.

Group	Cases	Length of treatment before two negative cultures for streptococcus hemolyticus
1	39	17 days
2	6	15 days
3	24	19.4 days
4	6	19.8 days
5	22	8.8 days

Total cases, 961. Average length of stay in ward, sixteen days.

It will be seen from table I that the results obtained in groups 1, 2, 3 and 4 were with slight variation about the same. That obtained from a 25 per cent solution of silver nitrate gave

the best results in that the stay in the ward before two successive negative cultures were obtained was only 8.8 days.

Another series of experiments were carried out as shown in Table II.

TABLE II.

Group 1	Culture 1	Culture 2	Culture 3	Culture 4
Tonsil 1	+ + +	—	—	+
Tonsil 2	+ + +	—	—	+ +
Tonsil 3	+ +	—	—	+ +
Tonsil 4	—	—	—	—
Tonsil 5	+ + +	+	+ +	+ +
Tonsil 6	+ + +	+	+ + +	+ + +
Tonsil 7	+ + +	+	+ + +	+
Tonsil 8	+ + +	—	+	—
Tonsil 9	+ + +	—	+ + +	+ + +
Tonsil 10	+ + +	+ +	+ + +	+ + +

Group 2	Culture 1	Culture 2	Culture 3
Tonsil 1	+ + +	—	—
Tonsil 2	+ + +	+	+ + +
Tonsil 3	+ + +	—	—
Tonsil 4	+ + +	—	+ + +
Tonsil 5	+ + +	—	+ + +
Tonsil 6	+ + +	—	+ + +
Tonsil 7	+ + +	—	+ + +
Tonsil 8	+ + +	+	+ + +
Tonsil 9	+ + +	—	+ + +
Tonsil 10	+ + +	—	+ + +

Plates from tonsils 1, 2, 3 and 4 group I, cultures 2 and 3 are inaccurate because silver nitrate was not completely neutralized with sodium chloride. In this group note marked increase in colonies of culture 3 as compared with culture 2. Culture 3 was after tonsils had been squeezed. Note also increase of colonies on face as shown in group 2, culture 2. In first group crypts were irrigated with 2 per cent silver nitrate.

Group I, Table 2, consisting of 10 tonsils, were treated and cultured as follows:

1. Culture from crypts of tonsils before application of 25

per cent silver nitrate and irrigation of crypts with 2 per cent silver nitrate.

2. Cultures from face of tonsil and superficial extremities of the crypts, after excess of silver nitrate was neutralized with sodium chloride.

3. Culture of face of tonsil after they had been greatly squeezed.

4. Culture from deep portions of crypts.

Group II, Table 2, consisting of 10 tonsils were treated and cultured as follows:

1. Culture before application of 70 per cent silver nitrate to face of tonsil.

2. Culture from face of tonsil after excess of silver nitrate had been neutralized with sodium chloride.

3. Culture from deep portions of crypts.

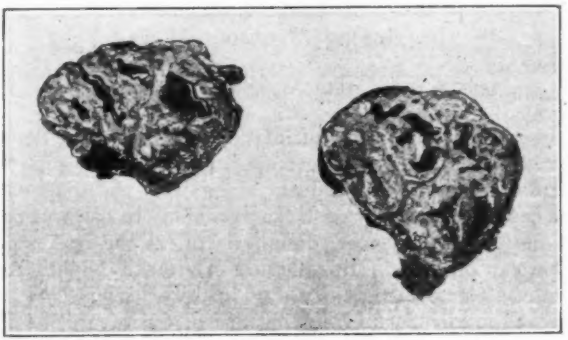
It seems evident that it is impossible to sterilize the tonsils with their innumerable crypts running in every direction. The face of these tonsils, although sterile immediately following an application of 25 per cent silver nitrate becomes contaminated with streptococci from the crypts as soon as sufficient pressure is brought to bear upon the surface of the tonsil as in deglutition or in vomiting.

Post operation findings in a series of 20 cases showed pure streptococcus hemolyticus from the crypts of excised tonsils in 18 cases or 90 per cent, and negative in 2 cases or 10 per cent. Adenoids were found in 3 of these cases and were positive in one case or 33⅓ per cent, and negative 66⅔ per cent. Of these 20 cases six or 30 per cent never gave positive culture after operation. The remaining 14 showed positive culture from the fossæ and they were treated daily with a local application of 10 per cent solution of silver nitrate. These throats became negative 10.7 days after operation.

From the above it will be seen how futile local treatment is in attempting to eradicate the streptococcus hemolyticus from the tonsils. While it may be possible to sterilize the surface of the tonsil and some of the crypts there will nevertheless remain, a number of these crypts that are inaccessible to any chemical means of disinfection. Granting that all the crypts were accessible there still remains the possibility of still further disease in the deeper and more inaccessible parts of the gland.

It is probable within the experience of all who have enucleated many tonsils to find on sectioning a large or even multiple abscesses which gave no evidence of their presence.

Photograph I shows a sectional tonsil injected with lamp black and a large cavity located in its center.



This case may have given a negative culture for the surface and crypts and still be a menace, needing only some intercurrent disease such as measles or scarlet fever to lower the patient's vitality and to light up and make more active the organisms located in the abscess.

We consider, therefore, all local treatment after the cultures show the presence of streptococcus hemolyticus as not only deceptive but a waste of time.

A complete enucliation of the tonsil is necessary.

Any tonsillar tissue remaining after an incomplete operation harbors the organism and the patient continues to be a carrier.

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XV.

THE BACTERIOLOGY OF THROAT CARRIERS OF STREPTOCOCCUS HEMOLYTICUS.*

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In controlling the spread of infectious diseases, the detection of healthy carriers of the specific organisms is a recognized part of the laboratory program along with the diagnosis of actual cases and vaccination when available. In diseases spread from the mouth and nose, diphtheria offers the best example of what can be done by this method of attack. Diphtheria bacilli can be found in the throats of healthy carriers by suitable cultures; the virulence or significance of the organisms found can be determined; chronic carriers of virulent organisms, who are usually immune themselves, can be isolated or cured by tonsillectomy; acute carriers of virulent organisms can be examined for immunity by a skin reaction, and if not immune can be immunized by antitoxin and isolated. In passing, it may be said that this program is rarely ever completely realized in practice on account of the amount of work involved, but parts of it are of practical value. In the prevention of epidemic meningitis, carrier work also has its place, which has been made more definite by the recent differentiation of types of meningococci. In lobar pneumonia, too, the differentiation of types of pneumococci has made the carrier problem more definite and practicable by excluding certain less important but prevalent groups from consideration.

In hemolytic streptococcus infections, however, the carrier problem is difficult. No virulence test or differentiation of groups is available, and the number of apparent carriers may be very large. In a recent survey of attendants and patients

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at the Walter Reed Hospital, Simmons[1] found the weekly carrier rate in March and April to be between 50 and 90 per cent with no cases of streptococcus pneumonia.

Judged by the evidence available at present, these streptococci are as good streptococci as those isolated from exudates in fatal cases of streptococcus empyema or meningitis. By analogy and experience we are forced to believe that some of these organisms found in carriers are pathogenic and that others are practically saprophytes, but until we know which are which we are equally forced to consider them all as potentially dangerous.

A word may be said here about nomenclature. The term streptococcus hemolyticus has been recently coined and in itself does not stand for a definite biologic species. It means simply hemolyzing streptococci, of which there are at least two kinds, human and bovine. For clinical purposes, however, it is synonymous with the older term, "streptococcus pyogenes," which culturally forms a single species. Using Holman's classification based on sugar reactions, different species may occasionally be found among the hemolyzing streptococci of the throat, but, as has been said, the great majority of these organisms are culturally identical.

A word may also be said about the hemolyzing enzyme. This is apparently not of clinical significance in the way of producing anemia. At least, in a series of ten cases of severe streptococcus infection, compared with ten cases of severe pneumococcus infections at the Walter Reed Hospital, no difference could be seen in the hemoglobin estimations; both series showed a secondary anemia averaging about 70 per cent. Like pigment formation in certain bacteria, the property of hemolysis in streptococci seems to be a metabolic activity that has no clinical equivalent.

The detection of carriers of streptococcus hemolyticus is fairly simple and resolves itself into a question of obtaining suitable material from the patient and of making a suitable examination in the laboratory.

The specimen of the flora of the throat is usually obtained as in examinations for the diphtheria bacillus by passing a sterile cotton swab over the fauces and posterior wall of the pharynx. In strongly positive cases material collected in this

way is satisfactory. It is known, however, the crypts of the tonsils are the most frequent habitat of hemolytic streptococci.[2] The evidence for this conception is as follows: 1. Cultures from the surfaces of the tonsils are positive more frequently and more strongly than cultures from any other area of the nasopharynx. 2. Crypt cultures in vivo are positive in a higher percentage of cases than surface cultures. 3. Crypt cultures of excised tonsils are positive in a high percentage. 4. Excision of the tonsil is the surest way of curing carriers. Under these circumstances it is evident that cultures of the tonsils are the most reliable source of material. In a series of fifty normal cases examined at the Walter Reed Hospital 28 per cent were positive with the ordinary throat cultures, while 50 per cent were positive by crypt cultures, an error of 22 per cent in the ordinary examination. A proper tonsil culture can be taken only with due care as to exposure and instruments, and is preferably made with the help of a laryngologist, although a light massage of the tonsil with the end of the swab suffices to bring out crypt contents in most cases.

Streptococci in such material are not very delicate and withstand some drying and change of temperature, but of course should be cultured with reasonable promptness. The standard culture media for the first inoculation is blood agar. As originally introduced by Shotmüller in 1903, this consisted of 40 per cent blood, but the percentage used at present is 5 to 10 per cent defibrinated human, rabbit or sheep blood. The various technical steps in working out a positive culture are fully stated in the methods for identification of streptococcus hemolyticus adopted by the Medical Department, U. S. Army, June 1, 1918.[3] The method consists in subculture of the original hemolyzing colonies into plain broth for further identification by means of morphology, bile solubility and a second hemolysis test. This requires 48 hours. In large surveys by experienced workers, the original surface culture answers the purpose in most cases, and the result can be given in twenty-four hours. A prompt report is of course desirable in case of patients admitted to hospital or of recruits under quarantine.

The streptococci thus isolated seem to form a strikingly similar group of organisms, as judged by many of the usual procedures in bacteriology. Slight differences in morphology

of certain cultures as to size of organisms, length of chains or appearance of colonies, etc., have been noted, but when due allowance is made for cultural conditions, these differences do not appear significant. The degree of hemolysis is also an uncertain criterion for differentiation. Virulence tests are made by injecting different quantities of broth culture intravenously in rabbits or intraperitoneally in mice or rats. The striking feature about these tests is the absence of difference in cultures from clinically virulent infections and from healthy carriers. From both kinds of cases a comparatively large amount of cultures is necessary to kill an animal on first inoculation, but the virulence can be raised somewhat by animal passage.

Differences in ability of different organisms to break up various sugars has long been used in bacteriology as a means of differentiation, as is illustrated by the typhoid colon group, but on various sugars these streptococci behave in much the same way. The following table gives the results of a careful examination of 100 strains; over half of these were from carriers, while the others came from definite streptococcus infections. During the course of this work several differences appeared at first, but as each tube was examined for purity and for growth and the examination repeated when necessary all differences disappeared and the results were uniform.

Sugar reactions of 100 strains of hemolytic streptococci:

Source of Strain	Number	Glucose	Lactose	Saccharose	Mannite	Maltose	Dextrin	Inulin	Salicin
Tonsils excised	43	+	+	+	—	+	+	—	+
Throat carriers	26	+	+	+	—	+	+	—	+
Empyema	18	+	+	+	—	+	+	—	+
Miscellaneous (middle ear, etc.)	11	+	+	+	—	+	+	—	+

One advance, however, has already been recorded in the simple differentiation of bovine and human types worked out by Avery and Cullen.[5] These workers have shown that the end reaction of bovine and human strains have a sharply defined range in the hydrogen ion concentration scale and that the simple addition of an indicator such as methyl red serves to distinguish the acid bovine strains with a range from 4.3

to 4.5 from the less acid human strains with a range of 4.8 to 5.3. This advance seems to dispose of one false lead proposed to explain the recent epidemics of streptococcus infections in the army—namely, that they came from milk, butter and cheese. Milk can, of course, spread hemolytic streptococci, but the bovine types are of no clinical significance, and milk is dangerous only if it has been contaminated by human strains. This differentiation may rule out a few cases of bovine strain carriers.

Immunologic Differentiation.—By analogy, with the pneumococci the most promising field is that of differentiation by agglutination. As is well known in the case of pneumococci, the separation of types has been of great value in diagnosis, prognosis, prevention and treatment by focusing attention on certain groups which are more important than the ordinary pneumococci found in the mouth. Some preliminary work of this kind has already been reported by Havens,[6] although the possible clinical significance of a separation of this kind is not yet known. On the other hand, according to Kinsella and Swift,[7] the method of complement fixation again shows that these streptococci are alike.

It is evident that practical measures for the control of streptococcus infections through the carrier point of attack must depend on the result of bacteriologic studies. If streptococci can be differentiated into more or less important groups attention can be directed to carriers of the most important group. On the other hand, if the streptococci are all equally dangerous, measures must be based on this fact, but if this is the case frankness demands the statement that the problem will be very difficult on account of the large number of the carriers which exist at present. It is to be hoped that bacteriology may also contribute some specific answer to the following questions:

Is the chronic carrier the reservoir of streptococcus infections or is the disease spread chiefly by cases and by acute contact carriers? Is the chronic carrier dangerous to himself or is he immune? So far the answer to these questions must be attempted on epidemiologic evidence, as no reliable test for virulence or immunity is available in the way of skin reactions or serum reactions.

SUMMARY.

1. Satisfactory carrier work in the effort to control the spread of hemolytic streptococcus infections is difficult for the following reasons:

(a) The carriers may be very numerous, including over one-half of the population.

(b) The streptococci found are nearly all identical culturally with each other and with streptococci isolated from streptococcus lesions.

2. The problem will be made easier if progress is made in regard to—

(a) Virulence or specific test to determine the danger of chronic carriers to themselves and others.

(b) Some differentiation of groups which would limit the work to a practical basis.

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XVI.

BACTERIOLOGY OF STREPTOCOCCUS HEMOLYTICUS.

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The importance of the problem of the systematic classification of bacteria for the proper understanding and control of infectious diseases is becoming increasingly evident. Such study is necessary, not only in the elucidation of the biologic relationship existing between varieties of the same species of bacterium, but it is also essential to the intelligent working out of epidemiologic problems and to the development of knowledge useful in the effort to control infectious diseases by means of specific therapeutic and prophylactic measures. Bacteria closely resembling those responsible for the pathologic process in many acute infections have been found to be present and to live, apparently without harm to the host, on the mucous membranes of a large proportion of normal individuals. The resemblance of the pathogenic to the harmless variety of microorganism is frequently so close that in many instances tests of particular specificity are required to show the existing biologic differences. In fact, the problem in etiology today is to determine not only the bacterial species causing a given disease, but in addition how many varieties of the same species are pathogenic, and whether common and important nonpathogenic varieties exist. The study is one of varying complexity, and methods suitable to one species do not give the desired information when applied to another.

The intent of such studies may be broadly defined as an effort to relate fixed and determinable characteristics of bacteria to pathogenicity. Though fluctuating variations of bacteria probably occur, it seems not unlikely that in most diseases a sufficiently constant equilibrium has been attained to

justify the usefulness of the effort. The methods employed in these studies are numerous. In some species morphologic and cultural characters give important though somewhat limited information, and in many the biochemical reactions are of great significance. The most serviceable method, however, for obtaining the particular kind of knowledge desired is the study of immunologic relationships. For some as yet unexplained reason these latter specific reactions are very constant among the pathogenic varieties. In the following study of S. hemolyticus, chief dependence has been placed on the knowledge obtained from the study of such immunity reactions.

In the various classifications of the streptococcus group as a whole that have been proposed, the custom has been to consider such strains as effect of hemolysis of red blood cells as constituting a single or unit type. The validity of this assumption has been questioned, and there has been much study and discussion of the probability of the existence of variations within this group, some evidence of which has been obtained from the study of sugar fermentations. Recent studies indicate that certain broad lines of differentiation may be shown between hemolytic streptococci of human origin and those of bovine origin, whether found in milk or cheese. Hemolytic streptococci of the human type are usually found in association with some pathologic process, such as puerperal sepsis, septicemia, erysipelas, bronchopneumonia, or other conditions, and hemolytic activity is generally considered as an indication of pathogenicity. With the development of our knowledge, however, these organisms have been found with increasing frequency when no pathologic lesion has been apparent. Investigators for many years have been interested in these strains, and discussion has centered about the unity or multiplicity of the group. The evidence in general favors the belief that hemolytic streptococci pathogenic for human beings comprise a single type. In the present paper it will be shown that by the use of properly controlled immune reactions differential characters between individual strains can be shown to exist.

The strains of hemolytic streptococcus discussed in the present paper, all possessed the typical characteristics of the

group. They are hardy organisms and grow readily in meat infusion broth and on blood agar slants. They survive for many months when grown for eighteen hours in rabbit's blood broth and subsequently placed at refrigerator temperature. In meat infusion broth the growth has been of two types—a granular sediment with clear supernatant fluid and a flocculent sediment with turbidity throughout the remainder of the tube. All the organisms are strongly Gram positive, grow in chains of varying length and are bile insoluble. Capsule formation has not been observed. On plates two types of colonies are seen—a small, round, smooth colony and a moist ameboid colony with a slightly roughened surface. All the strains are actively hemolytic, showing a wide zone of hemolysis on the surface of rabbit's blood agar plates, and hemolysis is complete in two hours, when a five per cent suspension of washed rabbit's blood cells suspended in salt solution is mixed with an equal quantity of a twenty-four hour broth culture. The power of the different strains to ferment the usual test substances for streptococcus has been studied. The majority fall in the group of S. pyogenes according to Holman's classification of streptococcus on a basis of sugar fermentations. None of the strains ferments inulin and about twenty per cent of these actively hemolytic strains possess the power of fermenting mannit. This latter characteristic will be shown to have an interesting relationship to the immunologic classification of these organisms.

Although the finer differential classification of single species of bacteria by means of immune reactions is still in the early stages of development, enough evidence has been gathered to indicate that the more highly parasitic varieties of the species are more likely to consist of a limited number of unit types than are the less parasitic or the saprophytic members. In other words, unity of type seems to characterize the disease producing microorganisms, whereas heterogeneity is more common among the nonpathogenic. If this assumption is true, it then becomes important to choose for purposes of classification such immune reactions as bring out most sharply the kind of differences sought, rather than a reaction which develops the basic relationship existing between all strains of the same species. For this purpose we regard the reactions of agglu-

tination and protection as of superior usefulness to those of precipitation and complement fixation. The validity of any final classification arrived at, of course, depends upon the possibility of fitting accurately into such a classification a large number of strains freshly obtained from their natural environment.

Specific agglutination has been found to be one of the most serviceable immune reactions for purposes of the biologic classification of bacteria. In the typhoid and pneumococcus groups, for instance, it serves to distinguish clearly the different varieties from one another. It is likewise applicable to the classification of many other microorganisms. Efforts to classify the streptococci by means of this reaction apparently have not illuminated materially the relationship of one strain to another, nor have they shown a definite relationship between certain strains and a particular pathologic process. A number of explanations of this fact may be proposed. In many instances no attention has been paid to the broader groupings of streptococci as determined by hemotoxin production and the fermentation of test sugars. Also streptococcus most frequently acts as a secondary invader in the production of disease, and it is probably an unwarranted assumption to suppose that type specificity is closely related to the character of the pathologic process. One of the chief obstacles to the successful carrying out of the agglutination reaction has been the tendency of all types of streptococcus to undergo spontaneous granulation, and when used for tests to exhibit the phenomenon of "nonspecific aggulation." As a result of this, the reactions must usually be read against a more or less granular background, making it difficult, if not impossible, to distinguish between the "nonspecific" and the specific influences. The tendency to spontaneous clumping is occasioned by a variety of factors, only a few of which are understood. For instance, a homogeneous suspension of a granular streptococcus can easily be prepared by washing the organism several times with distilled water, and then resuspending in the same medium. Such a suspension will remain homogeneous for an indefinite period of time. If sodium chlorid in concentrations above 0.06 per cent be added to the suspension, granulation immediately ensues. Many other salts act in the same

manner. Substances antagonistic to this salt action exist and may be added to the medium and function even to the extent of suspending the participation of the salt in the immune reaction, so that specific agglutination may be completely inhibited. Fortunately intermediate combinations can be found in which most strains remain diffuse and in which the salt is still able to fulfill its rôle in the immune reaction. The most useful substance of this kind is ordinary meat infusion broth to which one per cent peptone has been added. In addition, if streptococci are exposed to too great acidity the tendency to granulation is increased. In order to avoid this, the reaction of the medium may be so adjusted and such quantities of balanced phosphate solutions added that during growth an acidity greater than pH 7.1 is not attained. Certain other undetermined factors cause granulation, which may be defined as a general unsuitability of the medium for growth, and these can only be eliminated by experimenting with a variety of preparations.

The immune sera used in the agglutination and protection tests were obtained by the immunization of rabbits, sheep and dogs. The animals were inoculated intravenously with repeated doses of heat killed organisms, and in most instances a certain number of doses of living organisms were given. The employment for immunization of freshly isolated unpassed human strains, or the use of the same strains after a series of animal passages, does not alter in any recognizable way the specific qualities of the serum. The agglutinin and protective titer of the sera has remained undiminished for many months after the time of bleeding.

Great care is taken in the preparation of the organisms to be used in the agglutination reaction. The broth is made from carefully selected meat, and instead of the usual sodium chlorid a sufficient quantity of a balanced phosphate mixture is added to give the required salt concentration and to adjust the hydrogen ion concentration at a pH of 7.4. Experience has taught us that when no sugar is added to the medium, S. hemolyticus grown for twenty-four hours in such a medium does not develop an acidity greater than pH 7.2, which is just above the point at which the tendency to granulation appears. The organisms are removed from the culture

medium by centrifugalization and are washed once or twice in broth with a pH of 7.4 prepared in the manner described above. They are then resuspended in the same medium in approximately the concentration that is attained after twenty-four hours' growth and are ready for use in the reaction. The sera to be employed in the tests are made up to the various concentrations by dilution with the same broth used for suspending the bacteria. The reaction of each specific serum is controlled by a complete series of like dilutions of normal serum of the same animal. Equal quantities of serum dilution and bacterial suspension are added to each tube, and the reactions are then placed at a temperature of 55° C. for one hour. A temperature of 55° C. must be accurately maintained during the entire period, and the tests must be read after the lapse of one hour, since if they are allowed to continue longer nonspecific granulation occurs. If clumping develops in the broth controls or in more than the first two or three dilutions of normal serum, the reaction is to be regarded as unsatisfactory and discarded. By the use of this technic, it has been possible to carry out reliable agglutination tests of various strains of S. hemolyticus and to show that constant type relationships exist, and that the various types are sharply differentiated from one another. An analysis of the results from the reaction of agglutination shows that in the collection of organisms studied it has been possible to detect four different types of S. hemolyticus. These types have been noted as Type S 3, Type S 23, Type S 60 and Type S 84, from the number of the chosen representative. In addition to the type strains, there remains a residue of unclassified organisms.

Study of the power of antistreptococcus serum to protect animals against experimental infection with this organism has given rise to a number of different points of view, both regarding its action against strains from different sources, and against the same strain before and after animal passage, and also concerning the kind and the different effects of varying antigens used in the process of immunization. Although in the present paper the classification of streptococcus hemolyticus by means of the agglutination reaction has been presented first, practically we have obtained our primary indications of the degree of antigenic differences between strains by means of the

reaction of protection. Later each reaction has been used to confirm the information obtained by means of the other.

In the successful carrying out of protection experiments, two things are of especial importance; first, the production of a serum of high potency, and second, the possibility of raising the virulence of the test strains of streptococcus to such a point that very minute doses of culture are sufficient to kill white mice in a limited period of time. We have been able to produce sera, in the manner alluded to above, of such potency that 0.5 cc. administered intraperitoneally is sufficient to protect a white mouse against one hundred thousand lethal doses of a highly virulent streptococcus. In order to produce such a serum many animals must be used, only a few of which may give the desired result. It has been possible to raise the virulence of many strains by continuous passage through white mice and rats to such a point that doses of from 0.000001 cc. to 0.00000001 cc. of broth culture are sufficient to kill the former animals in from twenty-four to forty-eight hours. These seemingly difficult conditions must be attained in order that sufficiently long range protective titers may be carried out to ensure the reliability of the information obtained. Protection against one or two lethal doses of a series of strains of streptococcus by a monovalent serum is subject to such a variety of interpretations that the evidence so gained cannot be considered of much value in judging accurately the antigenic relationship of the different strains.

Consideration of the results obtained from protection experiments shows that the type relationships manifest from the agglutination reactions have been substantiated by the evidence obtained from the protection tests. As a matter of fact, each reaction has been used to supplement the other, the first clue as to the position of an organism sometimes being obtained by protection and sometimes by agglutination. On the whole, we are inclined to place greater confidence in the reaction of protection than in that of agglutination, and would be slow to draw general conclusions concerning type specificity from agglutination alone with such a variable organism as streptococcus, unless the results of this test could be confirmed by some other specific reaction such as protection. The various sera prepared have afforded a high degree of protection

to white mice against infection with organisms of the homologous type. Little or no protection results when serum of one type is employed against organisms of heterologous types. There are, of course, some exceptions to this general rule. Occasionally strains of S. hemolyticus are encountered against which all type sera afford a varying degree of protection, and sometimes a serum is obtained from one strain which will protect against an organism of another type, and when the reaction is reciprocally reversed, no protection results. At present our knowledge is insufficient to discuss these intermediate reactions intelligently, and their elucidation must await further development of the technic.

The complete biologic classification of any pathogenic microorganism presents a very complex problem. The first phase of the undertaking concerns itself with the development of reliable methods for the determination of antigenic differences between members of the species and the application of these methods to the discovery of the immunologic relationships between a limited number of strains purposefully selected. In this way the degree of similarity and diversity of types is shown and also the probable number of types, and the proportion of classifiable to unclassifiable strains. The next step of necessity is the testing of the adequacy and universality of the information so gained by applying the tentative classification to a large number of strains of the organism obtained under what may be described as normal conditions of pathogenicity. That some sort of equilibrium has been established in nature among microorganisms that have produced disease over long periods of time is not unlikely. Indeed evidence obtained from the study of pneumococci supports this view, although departure from the norm may occur under special conditions. After the relationships of the pathogenicity of the species to one another have been discovered, it then becomes important for purposes of epidemiologic study to compare by the same methods the pathogenic with the saprophytic varieties. Such a task requires years for its completion, and many difficulties and seemingly unexplainable phenomena are encountered. In the beginning, the broader lines of differentiation must be drawn, and divergent results discarded for the time being, since, if

the original conception is correct, most of the discrepancies disappear with the advance of knowledge.

In this paper are presented the facts so far obtained in the present study of S. hemolyticus in accordance with the plan outlined above. The strains were collected in a limited community during the course of what may be considered an epidemic of bronchopneumonia secondary to measles. Individuals, however, from all parts of the United States were passing rapidly through this community, which was a center for primary training of the aviation service, so that a wider range of territory is represented than the immediate community itself. All the strains were investigated as to their cultural reactions, bile solubility, capacity to hemolyze red blood cells and to ferment the different test sugars, and as to the hydrogen ion concentration limiting their growth, and thus identified as accurately as possible as S. hemolyticus of the human type.

A technic was then developed for studying the immunologic reactions of agglutination and protection. By the reaction of agglutination four distinct immunologic types and a certain number of unclassifiable strains have been discovered among the 125 strains studied. Individuals of the same type are closely related to one another immunologically, and the different types can be sharply distinguished one from the other. In addition to the four types, study of the reactions of which has been completed, there are in addition two other types, investigation of which is as yet incomplete. The technic of the agglutination reaction demands great care, both as regards the handling of the organism and the preparation of the medium for their growth. In the medium used by us, a large percentage of strains have grown sufficiently diffusely to permit the preparation of stable suspensions. To what extent continuous growth in this medium has promoted the tendency to diffuseness, and whether the same percentage of freshly isolated strains will grow diffusely, we are as yet unable to say. We have found that by the immunization of sheep, a highly specific agglutinating serum is obtained, but that the serum produced from rabbits is not so specific and may show a wider range of crossing, especially in one of the types of streptococcus described. Variations in the specificity of different animal sera have been observed by students of the im-

munologic reactions of meningococcus. In order to fully understand this phenomenon, it would be necessary to compare the specificity of immune sera produced from different species of animals by means of the method of absorption. It is not as yet possible to undertake this kind of an investigation of S. hemolyticus. The observation has been made, however, that rabbit sera showing nonspecific cross agglutination reactions in general fail to manifest corresponding cross protection reactions.

Whenever it has been possible to raise the animal virulence of strains of S. hemolyticus, the evidence obtained from the agglutination tests has been confirmed by that gained from the protection reaction. In all instances in which this has been done, the one reaction has corroborated the findings of the other. The performance of reliable protection tests has been made possible by the production of sufficiently high titer antistreptococcus sera, and by the possibility of raising the animal virulence of a certain number of strains to a high degree. The type of S. hemolyticus have been noted as Type S 3. Type S 23, Type S 60, and Type S 84, from the serial numbers of the representative strains. This nomenclature is not put forth as a final one, since we realize that probably many other human types exist, to say nothing of the bovine and cheese varieties, and that the proportional distribution of the different varieties pathogenic for human beings may be very different from that represented by this work. Streptococcus is the largest of all pathogenic groups of bacteria, any many years will be required to bring out the information necessary to the perfecting of an adequate classification.

It is of considerable interest that all the members of Type S 60 ferment mannit, and that none of the members of the other groups so far encountered ferment this sugar. A few unclassifiable strains, however, have been found to be mannit fermenters.

This work has cleared up a number of points about S. hemolyticus which have been in dispute for many years. In the first place, S. hemolyticus of human origin is not a unit type as was previously supposed, but probably consists of a number of types, at least four of which have been definitely identified. Previous investigators have stated that freshly isolated human

strains change their antigenic properties on animal passage, and that the latter procedure for the development of animal virulence gives a common antigenic character to all strains. We have found no evidence to support this contention—in fact, immune sera produced with human strains that have never been passed through animals afford a high degree of protection against strains that have received many animal passages. In addition, the antigenic differences between strains of S. hemolyticus which have been passed through animals are quite as distinct as those between strains which have not been so passed. The types of S. hemolyticus studied have been obtained almost exclusively from the respiratory tract and from a limited source of supply, and there is some reason to believe that those which produce cellulitis, erysipelas and septicemia may be of somewhat different character. It is, therefore, readily seen that but a beginning has been made in the classification of S. hemolyticus, and that before the classification is complete, and the relative dominance of the different pathogenic varieties determined, much work must be done.

XVII.

THE RELATION OF STREPTOCOCCUS HEMOLYTICUS CARRIERS TO STREPTOCOCCUS EPIDEMICS IN THE ARMY.*

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Any consideration of the epidemiology of the widespread hemolytic streptococcus infections that have occurred in the army must of necessity be incomplete, since our knowledge is still in the formative stage, and there remain many gaps in the story that only further investigation can complete. It is merely necessary to state that no method for the immunologic classification of hemolytic streptococci has been available for us, nor has any method been devised to make certain whether a given streptococcus is virulent for man or not, to indicate two of the many difficulties that have confronted us. The relation that streptococcus carriers have borne to the prevalent streptococcus infections of the last two years is one of the most important phases of the problem.

Before entering upon a discussion of this subject it seems advisable to recall certain facts with respect to hemolytic streptococcus infections in general, since they serve to a considerable extent to orient us in the particular field to which this discussion is devoted. Two facts stand out preeminently above all others. Firstly, hemolytic streptococcus infections with but few exceptions are secondary in nature—that is, they occur in large part only in the presence of some preexisting disease or lesion which renders the individual susceptible to invasion by these organisms. This relation has been a matter of common knowledge for many years with respect to scarlet fever, puerperal sepsis, wound infection, erysipelas and other diseases. Certain exceptions, of course, exist as a conspicuous

*From the Army Medical School, Washington, D. C. Read before the annual meeting of the American Laryngological Association, Atlantic City, N. J., June 17, 1919.

example of which may be mentioned epidemic septic sore throat. The second outstanding fact with respect to hemolytic streptococcus infections is that they occur mainly in epidemic form. We are all familiar with the history, at least of the old time hospital epidemics of puerperal fever, wound infection and erysipelas. We have all seen epidemics of streptococcus sore throat. Here, again, the rule is not absolute, and isolated cases of streptococcus infection not infrequently occur without relation to a streptococcus epidemic. By way of comparison, Theobald Smith has drawn attention to the fact that streptococcus infections in animals also occur as epidemics, mainly as secondary, not primary infections.

The direct application of these facts to conditions as they have existed in the army is quite apparent if one surveys the whole field. It is well known that the streptococcus infections that have occurred have in very large part affected the respiratory tract, producing a secondary bronchopneumonia with frequent empyema. Otitis media and mastoiditis also have been very prevalent. It seems unquestionable that this is because the antecedent infections that have prepared the soil for secondary streptococcus invasion have been almost exclusively respiratory diseases, rather than that the streptococci in themselves have had primarily any special predilection for the respiratory tract. Two diseases have been especially prominent in this respect—measles and influenza. During the winter of 1917-18, when streptococcus bronchopneumonia first became prevalent in the army camps, it almost exclusively followed measles. In the spring months of 1918, however, it began to occur in increasing amounts independently of measles, as the reports of Fox and Hamburger[1] and Lucke[2] from Camp Taylor, of MacCallum[3] from Camp Dodge, and of the Empyema Commission[4] at Camp Lee clearly show. Similar cases were very numerous at Camp Merritt during April and May, 1918, where measles played a negligible rôle as a predisposing cause. The theory was put forward that the hemolytic streptococcus had attained such virulence by this time that it was capable of producing a primary bronchopneumonia in the absence of an antecedent infection of the respiratory tract. This may have been so to a certain extent. Without wishing to be too positive on the subject, it is believed, in view of sub-

sequent experience, that this socalled primary streptococcus pneumonia was in reality in large part secondary to influenza, which was for the most part unrecognized at the time. It is impossible to go in detail into the reasons for this belief. It suffices to say that it has been clearly shown by Soper,[5] by Opie and his collaborators,[6] and by others, that epidemics of influenza, differing from the fall epidemic only in degree, occurred in many of the army camps during the months of March, April and May, 1918. Rereading of the clinical, pathologic and bacteriologic reports referred to above will only serve to strengthen this opinion. The relation of influenza to streptococcus infections during the fall of 1918 is too fresh in the minds of all to require further comment. One other disease has also predisposed to secondary streptococcus infections to an extent not generally recognized, namely, lobar pneumonia. The reports of Cole and MacCallum,[7] Clendenning,[8] and Opie[9] have directed attention to this.

The epidemic character of the hemolytic streptococcus infections that have occurred in the army should be quite obvious to everyone, yet it is apparently often disregarded in discussions upon the relation of streptococcus carriers to secondary streptococcus infections. I wish particularly to emphasize the epidemic character of these infections, since it has a very important bearing on the rôle played by streptococcus carriers. That streptococcus bronchopneumouia has occurred in the form of epidemics rather than as an endemic disease such as pneumococcus lobar pneumonia, is clearly brought out by the fact that during the winter of 1917-18 it occurred very extensively in certain camps, particularly those in the south, while many of the northern and far western camps were almost entirely free from it. A similar selective incidence has occurred during the fall epidemic of influenza. In certain camps hemolytic streptococcus pneumonia has been conspicuous by its absence, while in others it has been exceedingly prevalent. The epidemic nature of these streptococcus infections was very evident at Camp Pike during the fall epidemic of influenza. Streptococcus pneumonia did not appear to any extent until the influenza had reached its height. It then gained very rapid headway and increasingly complicated or replaced secondary pneumococcus pneumonia as the influenza

epidemic declined. Similar observations have been reported by Goodpasture[10] from the Naval Hospital in Chelsea, by Rackemann and Brock[11] at Camp Merritt, and by Blanton and his collaborators[12] at Camp Custer.

It is quite clear, then, that the hemolytic streptococcus bronchopneumonia, otitis media and mastoiditis that have been so prevalent in the army have not differed from hemolytic streptococcus infections in general in their two principal features—that is, they have been almost entirely secondary infections, and they have been truly epidemic in character. With these two facts clearly in mind we can much more intelligently approach the subject of streptococcus carriers in their relation to the streptococcus epidemics that have occurred in the army.

In speaking of streptococcus carriers it is necessary in order to avoid confusion to divide them into three groups: (a) chronic carriers, individuals who carry the hemolytic streptococcus over long periods of time; (b) contact or temporary carriers, those who acquire the hemolytic streptococcus and carry it for a relatively short time without its causing them any apparent injury; and (c) acute carriers, those who acquire the organism and in whom it produces disease. The first group is represented by individuals with more or less definitely pathologic tonsils, in the crypts of which hemolytic streptococci find a suitable place for continued existence. The reports of Nichols and Bryan[13] and Pilot and David[14] have dealt with this type of carrier. Undoubtedly opinion differs with respect to the incidence of these chronic carriers. It may be safely stated, however, that most observers who have had wide experience in the study of the bacterial flora of normal throats agree that hemolytic streptococci are found with rarity in the absence of streptococcus epidemics. Little data is available with respect to the incidence of temporary carriers of hemolytic streptococci under normal conditions, but with little doubt their number and importance are negligible, since, as has been stated, hemolytic streptococci are infrequently found in normal throats in the absence of a streptococcus epidemic. On the other hand, under the abnormal conditions that have existed during the past two years in the rapid assembling of large groups of men in our army camps, contact or temporary carriers of hemolytic streptococci have become very numerous

and probably have played a very important part in the development of the widespread streptococcus epidemics. It is only necessary to contrast the incidence of streptococcus carriers among new recruits before they have entered camp with that among men who have been in camp for varying periods of time to indicate the extent to which contact carriers may develop. In a group of 489 newly drafted men cultured as they arrived at camp, Levy and Alexander[15] found 14.8 per cent to be carriers of hemolytic streptococci, while among men who had been in camp for a period of six months the incidence of carriers was 83.2 per cent. The third group of acute carriers is represented by the cases of streptococcus pneumonia, mastoiditis, tonsillitis, etc., and needs no further definition. It is of course obvious that the contact carrier may become an acute carrier if he develops measles or some other predisposing disease which renders him susceptible to invasion by the hemolytic streptococcus. Whether the chronic carrier may do so or not, is not so clear. Data which I will present would seem to indicate that he rarely does so, except possibly as a terminal event in chronic diseases.

Two points of view with respect to the relation of streptococcus carriers to streptococcus epidemics have been advanced. The first has been expressed in a recent editorial in *The Journal of the American Medical Association*,[16] from which I quote in part: "As hemolytic streptococci commonly present in the crypts of the tonsils are probably the most important source of the streptococcic complications of various acute infectious diseases in persons innocently harboring the microorganisms, it is important to ascertain how the secondary infections from them arise. At any rate, it seems more reasonable, on the basis of knowledge available, to charge the responsibility to the tonsil borne bacteria rather than to an invasion of unusually virulent strains from outside the body. Outbreaks of disease due to the entrance of foreign virulent streptococci unquestionably do occur at times, as the epidemics of septic sore throat testify; but in general the streptococcic infections are presumably associated with preexistent foci, like the tonsils, which harbor the bacteria in the body." In brief, this is the theory of autogenous infection. The other point of view is indicated in the above quotation, namely, that

the secondary streptococcus complications are in large part due to invasion of virulent strains from outside the body—that is, to contact infection.

Although it is admitted that our knowledge is still far from complete, examination of all the available evidence would seem to indicate that the theory of contact infection is the only logical one with respect to the widespread streptococcus epidemics that have occurred in the army. In support of this opinion I wish to present briefly certain studies made at Camp Pike by the Pneumonia Commission headed by Colonel Opie.* This study covered the entire period of the 1918 fall epidemic of influenza from its beginning in early September until influenza had nearly disappeared in mid December. During the same period a considerable epidemic of measles occurred at Camp Pike. A particularly good opportunity to study the relation of streptococcus carriers to the development of streptocuccus complications of measles, influenza and influenzal pneumonia was afforded, since the number of streptococcus carriers among normal men and among those entering the base hospital with measles, influenza and pneumonia at the beginning of the study was at a low ebb following the favorable conditions that had existed during the summer months when respiratory diseases were at a minimum and streptococcus infections were nearly absent.

Three groups of normal men were studied. The first consisted of 64 drafted men assembled at Hot Springs, Ark., preparatory to entraining for Camp Pike. These men were from isolated rural communities, were cultured as soon as they reported at the place of assembly, and therefore afford an excellent base line. Throat cultures in all were negative for hemolytic streptococci. The second group consisted of 337 men from various organizations at Camp Pike. They had entered camp in the June, July and August drafts. Twenty-five, or 7.4 per cent, were positive for hemolytic streptococci. The third group consisted of 65 normal individuals, compris-

*These studies are to be published in detail by members of the commission. The members of the commission were Lt. Col. Eugene L. Opie, M. M., Major Allen W. Freeman, M. C., Capt. Francis G. Blake, M. C., First Lieut. James C. Small, M. C., and First Lieut. Thomas M. Rivers, M. C.

ing the nursing and medical corps personnel of the measles wards during September. Six, or 9.2 per cent, were positive for hemolytic streptococci. For the purpose of argument it may be assumed that the positive cases represented chronic carriers, although it must be conceded that some may have been merely contact or temporary carriers. These figures are comparable with those of Levy and Alexander[13] for men cultured upon arrival at Camp Taylor. The incidence of streptococcus carriers among men admitted to the base hospital with measles, influenza or pneumonia was quite similar. Eight hundred and sixty-seven cases of measles admitted between September 15 and December 15, showed only 37, or 4.3 per cent, positive for hemolytic streptococci on the first culture at time of admission. Eighty cases of pneumococcus pneumonia cultured during September showed only 1, or 1.3 per cent, positive for hemolytic streptococci. Throat cultures in 100 cases of influenza, made shortly after admission to the hospital on September 25 and 26 when the influenza epidemic was approaching its height, showed 6, or 6 per cent, to be positive for hemolytic streptococci. As with the normal men it may be assumed that the positive cases represented in the main chronic carriers of hemolytic streptococci. I wish to emphasize two points of particular interest with respect to these chronic carriers. The first is their relatively low incidence in the absence of a streptococcus epidemic. The second is that none of these chronic carriers admitted to the hospital with measles, influenza or pneumonia developed secondary streptococcus infections, although suffering from respiratory diseases preeminently leading to secondary invasion by the hemolytic streptococcus.

Simultaneous observations of the development of contact or temporary carriers yielded very interesting results. But one group of normals is available. Eighty-eight individuals of the medical corps personnel on the measles wards were cultured in November after streptococcus complications had become fairly prevalent among measles patients. Sixteen, or 18.2 per cent, were positive for hemolytic streptococci, an increase of 100 per cent over the figures for September. Cultures were made in 138 cases of influenza between November 27 and December 5 at time of admission to the hospital. Thir-

ty-nine, or 28.3 per cent, were positive, an increase of approximately 400 per cent over the figures for September. Not only was there a marked increase in the actual number of carriers but the much greater predominance of hemolytic streptococci over other bacteria on the plates was often very striking. It is believed that this increase in the number of streptococcus carriers was dependent upon the dissemination of hemolytic streptococci coincident with or following a considerable epidemic of streptococcus infections that started at the height of the influenza epidemic during the last week of September and that the majority of these cases represent temporary or contact carriers.

The development of contact carriers in the measles wards was studied by weekly throat cultures. Of the 830 cases of measles negative for hemolytic streptococci at the time of admission to the hospital 205, or 24.7 per cent, acquired the hemolytic streptococcus while in the hospital. The development of streptococcus complications amog these contact carriers is in striking contrast with their absence among the chronic carriers. These complications were: Bronchopneumonia, 9; otitis media, 27; mastoiditis, 14; meningitis, 2; suppurative arthritis, 1; acute tonsillitis, 4. These cases, therefore, became acute carriers, while the rest remained simply contact carriers without developing streptococcus infections, possibly an indication that the streptococci which were becoming more and more prevalent had not attained that degree of virulence which they attained in the spring of 1918. It is noteworthy that among these cases of bronchopneumonia, otitis media, and mastoiditis the complication developed in all but five instances nearly coincidentally with the acquisition of the hemolytic streptococcus by the patient in so far as the limitations of weekly throat cultures could determine.

Even more striking evidence of the contact nature of these streptococcus infections was obtained in certain ward studies among patients suffering with influenzal pneumonia. These may be summarized briefly. In wards 3 and 8, between September 6th and October 5th, 163 cases of influenzal pneumonia were admitted, of whom 49, or 30.1 per cent, died. Cultures at autopsy showed that only two of these cases had streptococcus pneumonia. In striking contrast with this were the con-

ditions in wards 1 and 2. Between September 24th and October 5th, 141 cases of influenzal pneumonia were admitted to these wards. Of these, 72, or 51.1 per cent, died. Cultures at autopsy showed that 43, or 59.7 per cent, of these 72 fatal cases had a secondary hemolytic streptococcus pneumonia. To appreciate the full significance of this striking difference between wards 3 and 8 on the one hand and wards 1 and 2 on the other, it is necessary to state that the patients admitted to these wards were in no sense selected. Sputum and throat cultures in cases admitted to wards 1 and 2 made prior to or shortly after admission to the ward showed that the majority of them, as in wards 3 and 8, were pneumococcus or mixed pneumococcus and bacillus influenzæ pneumonias free from hemolytic streptococci at time of admission. The widespread and highly fatal secondary hemolytic streptococcus epidemic in wards 1 and 2 was shown to directly follow the introduction of a few cases of streptococcus pneumonia into these wards. Such a strikingly selective ward incidence of secondary streptococcus pneumonia can leave little doubt that these cases were due to invasion by highly virulent streptococci through contact infection from acute carriers. Even should it be granted that the majority of all these cases in both groups of wards were chronic carriers of hemolytic streptococci which the limitations of the throat culture method had failed to detect, the theory of autogenous infection can hardly be sustained in the presence of the almost complete selective incidence of secondary streptococcus infections between the two groups of wards.

In summary, our studies at Camp Pike showed that in the absence of a streptococcus epidemic the incidence of hemolytic streptococcus carriers among normal men and among patients admitted to the base hospital with measles, influenza or pneumonia was relatively low, not exceeding 10 per cent in any of the groups studied. It may be conceded that these represent chronic carriers. Following the outbreak of an epidemic of streptococcus infections the incidence of streptococcus carriers among normal men and among patients admitted to the base hospital with influenza showed an increase of from 100 per cent to nearly 400 per cent. It is believed that this increase represents a group of contact or temporary carriers

due to the dissemination of hemolytic streptococci coincident with the streptococcus epidemic. Contact carriers also developed to a considerable extent among patients with measles during their residence in the hospital wards. Secondary streptococcus complications occurred exclusively among these contact carriers, chronic carriers of hemolytic streptococci among patients with measles, influenza and pneumonia remaining free from streptococcus complications. In the majority of instances in which patients with measles developed a streptococcus complication, the onset of the complication was nearly coincident with the acquisition of the hemolytic streptococcus by the patient. Highly fatal ward epidemics of secondary streptococcus pneumonia among patients with influenzal pneumonia were shown to be due to contact infection and were directly traceable to acute carriers of hemolytic streptococci.

It remains to correlate these results with similar studies made by many observers during the spring of 1918, since there are certain noticeable differences, especially with respect to the incidence of streptococcus carriers and their relation to the development of secondary streptococcus complications. Only the report of Levy and Alexander[15] from Camp Taylor will be considered, since this is fairly representative of conditions as they existed at that time and has been widely quoted in support of the theory of the wide prevalence of streptococcus carriers and of autogenous infection. It will be recalled that in a group of 95 normal men who had been in camp for approximately six months, 83.2 per cent were found to be carriers of S. hemolyticus. A similar high incidence of streptococcus carriers, 77.1 per cent, was found among 388 cases of measles at time of admission to the hospital. Streptococcus complications, which were fairly frequent, occurred almost exclusively among these men who were carriers at time of admission. In contrast with this high incidence of carriers among men resident in camp for six months, the incidence of carriers among 489 new recruits cultured upon arrival at camp was but 14.8 per cent. In analyzing these results it is necessary to point out that at the time the studies of Levy and Alexander were made a very extensive epidemic of secondary streptococcus infections had existed at Camp Taylor for some time and was still unabated. In view of this fact, it

would seem highly probable that a very large proportion of the carriers among normal men and measles patients were contact or temporary carriers who had acquired the carrier state coincident with the widespread dissemination of streptococci that must occur in the presence of an extensive streptococcus epidemic. This is very clearly so, in view of the relatively low incidence of carriers among recruits who had not been in contact with the epidemic. With these points in mind it will be seen that the results obtained by Levy and Alexander are not out of harmony with those found at Camp Pike.

SUMMARY.

In summary, it may be said that the available evidence would seem to indicate that the widespread streptococcus infections that have occurred in the army have in very large part been due to invasion of virulent streptococci in individuals rendered susceptible by predisposing diseases, chiefly measles, influenza, and pneumococcus pneumonia through contact infection, either direct or indirect, and that autogenous infection has played an insignificant rôle in the production of these streptococcus infections. Their truly epidemic character and their strikingly selective incidence would seem to admit of no other interpretation. Even should it be granted that a large proportion of the population innocently harbor hemolytic streptococci in their tonsils as chronic carriers it is difficult to maintain the theory of autogenous infection, since it predicates an equal incidence of streptococcus complications of measles and pneumonia at all times.

The relation of chronic carriers to the development of streptococcus epidemics is uncertain and must remain so until means are available for showing whether the hemolytic streptococci harbored by them are immunologically identical with those responsible for the epidemics. It is not impossible that they may be the initial source of these epidemics which arise when an opportunity for the dissemination of the streptococci which they carry is provided by the assembling of large groups of men in intimate association. From the point of view of prevention it would seem wise to consider this assumption as true until it is disproved or otherwise. It must not be over-

looked, however, that the starting point may equally well be found among a number of acute carriers represented by cases of streptococcus tonsillitis which are probably not infrequently present among large groups of drafted men at the time of their arrival in camp.

The rôle played by contact or temporary carriers in the development of a streptococcus epidemic, likewise, cannot be finally established until we are possessed of methods for the immunologic identification of hemolytic streptococci. Sufficient evidence is available, however, to show that they bear an intimate relation to the streptococcus epidemics of the army, even if only a time relation. It seems not improbable that they represent to a considerable extent the intermediate hosts, if we may use the term, which serve to widely disseminate the streptococci and assist in increasing the virulence of the organism by frequent passage. They should at least be regarded as a potential source of danger until negative evidence has been produced. It is possible, however, that contact carriers play only a passive rôle and occur merely coincidentally with the dissemination of streptococci that takes place during a streptococcus epidemic. That contact carriers may become acute carriers in the presence of a predisposing disease has been brought out.

The part played by the acute carrier in the spread of streptococcus infections cannot be too strongly emphasized. It has been clearly shown that he is an actual source of great danger. The introduction of an acute carrier into a ward devoted to the care of respiratory diseases may be followed by a rapidly spreading and highly fatal epidemic of streptococcus pneumonia which is comparable in all respects to the old time hospital epidemics of puerperal sepsis. Rigid isolation of every such case is the clear indication.

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XVIII.

STREPTOCOCCUS CARRIERS—REMARKS MADE IN OPENING THE DISCUSSION.*

By Col. F. F. Russell, M. C., U. S. A.,
Washington.

Dr. Flexner in his address drew attention to the question of epidemiology and recent epidemics, and in tracing the history of influenza showed that it probably had a home at some place on the Russian-Turkestan frontier and that from that home it spread over the world from time to time; that anterior poliomyelitis spread over the world from time to time from its home in northwestern Europe (Scandinavia). The streptococcus problems that have just been placed before us present the same condition in a somewhat different way.

We have had from time to time epidemics of streptococcus infections, and the papers to which we have been listening present the last and best work that has been done in tracing back the epidemics to their home, which in this case is a widespread endemic home. We apparently have the seeds of an epidemic always with us, ready to break out when the conditions are favorable, as they were during the war. During the first part of the war measles was the primary disease which so altered the respiratory mucous membrane that the hemolytic streptococcus was enabled to invade the respiratory organs and produce a terrific epidemic of bronchopneumonia with which you are all familiar.

Epidemics of streptococcus infections are among the oldest problems with which the medical profession has had to deal. They have cropped out in various fields of medicine from time to time, and each group of medical men has solved the problem in its own way. We all recognize that the epidemics of streptococcus infections that we have had recently are quite comparable to the older epidemics of puerperal fever, of erysipelas, of wound infection which medical history tells us about. The obstetricians found a way of protecting themselves and their

*American Laryngological Association, Atlantic City, N. J., June 16-17, 1919.

patients against an epidemic of puerperal fever. They elaborated a technic which is successful. In the surgical field the same thing has been done, so that streptococcus infection in surgical wards is almost a thing of the past.

The experience of last year which Capt. F. G. Blake has so well described, shows that the conditions surrounding streptococcus pneumonia are practically the same as those surrounding erysipelas and puerperal fever, and that one ought not to admit into a ward full of patients with pneumonia or respiratory disease of any kind, a case of streptococcus pneumonia any more than he would think of admitting a puerperal fever case into a ward full of puerperal women.

In the papers which we have been so fortunate as to have today, we have gone a good step further and have arrived at cases which are on the borderline. There is no doubt, I think, that we can all accept Captain Blake's point of view, that the case of acute virulent streptococcus disease is a source of danger to everyone with whom it comes in contact in a ward. That, I think, you can all accept.

Whether the chronic carrier of the streptococcus is dangerous is the thing which we have to decide in the future. The acute case of tonsillitis is also fairly clear. Unless future work along the lines that Dr. Dochez has indicated shows that we can differentiate between a streptococcus found in the case of mild but acute tonsillitis is different from the streptococcus causing bronchopneumonia, otitis and mastoiditis and severe streptococcus infections—until we can differentiate between them, the only safe thing to do is to consider that the case of acute follicular tonsillitis, no matter how mild, is a source of danger to other persons in the ward. Whether the chronic carrier is also a source of danger is, I say, the problem that we have to work out for the future, and that is where the cooperation between the laryngologists and the laboratory men must play a part in the future.

I think these papers show quite clearly what our work is to be. We must study the prevalence of a chronic streptococcus carrier. Whether we shall find in civil life in times of peace when things are settled that the streptococcus carrier during the winter season is as common as it was in the camps or not, is the first thing to learn.

The few surveys we have at the present time seem to show that the chronic streptococcus carrier is not so very numerous, but the work which has been done on that is inadequate. We must combine and work together, and find out the prevalence of the chronic streptococcus carrier and also its significance. That is, we must have the histories extending through the year of the chronic streptococcus carrier, possibly for more than one year. We want to know what is the duration of the disease, whether the associates of the chronic carrier remain healthy or whether they developed disease.

Parallel with the work which Dr. Dochez has started, we can work on the bacteriologic side and try to find out whether the streptococci obtained from these chronic carriers are potentially able to cause epidemics of streptococcus diseases. The whole question of the streptococcus from the bacteriologic standpoint has been most difficult, and although it has been taken up from time to time to solve special problems, the work has languished frequently and even gone backward from time to time, but I think this work which we have heard today represents an advance that is greater than anything that has happened in recent years.

The older work on puerperal sepsis ceased when the question of the control of puerperal cases was decided upon. Not much more was done during the time of streptococcus infection in surgical wards, but when this widespread epidemic of bronchopneumonia, due to streptococcus, broke out, we all had to start in again and reexamine the old ground and see what could be done for the future. I think that a great deal has been done.

So long as we were unable to differentiate clearly between different kinds of streptococci, very little progress could be made. The field was too broad and it was impossible to make progress, but in the last two years the field has been much narrowed.

We know that the streptococcus pyogenes or the hemolytic streptococcus is the cause of the severe infections. The other nonhemolytic streptococci we can afford to disregard completely in this respect. That throws out an enormous number of streptococci which need not be further considered in this connection. Then we have a large number of hemolytic strepto-

cocci which are found in milk and cheese and bovine mastitis. We have also found methods and good reasons now for excluding those from consideration. They do not seem to be of any importance in human pathology, and that narrows the field very greatly until we have now a hemolytic streptococcus which comes from human sources and which is found in these epidemics and also in the acute and chronic tonsillitis.

These organisms are all we then need to study, and Dr. Dochez has shown how it is possible to split them up into four groups which can be further studied. We have got to find out some way of telling whether they are virulent or not, and whether they are pathogenic to human beings. Those are two difficult problems but perhaps they are not insuperable.

The question of acute tonsillitis we have always accepted as a disease due to the streptococcus. There is this curious thing about the streptococcus which have been emphasized in the papers we have heard—that the streptococcus plays the rôle of a secondary invader in every situation; it does not produce a primary disease in any place. We have tonsillitis in the human being, and strangles in the horse, which are apparently primary streptococcus infections. It might be well, however, to reexamine these two diseases with the possibility in view that they are not primarily streptococcus diseases, but that the streptococcus is a secondary invader just as in the other known streptococcus infections.

We have long known that as soon as we bring a lot of recruits together, whether in time of war or in time of peace, we immediately have a small or large epidemic of acute follicular tonsillitis. We have tried in various ways to prevent the extension of such epidemics. The only way which has offered any reasonable success is separating the men as far as possible; in fact, we have done exactly what was done in puerperal fever and erysipelas and in measles-pneumonia: we have kept our patients as far apart from one another as possible, and that has limited the spread, and it has been about the only measure that was effective.

The experience of pediatricians in the treatment of measles in children is practically the same. I am informed it is customary in children's hospitals to refuse admission to patients with measles whenever possible, because all their experience

has shown that every time they are brought together in a hospital the mortality is high; that the best way of keeping down the mortality is to leave the measles patients at home, no matter how poor their homes may be, in order to protect them against streptococcus infections.

Of course that solution for our difficulty during the war was not possible. We could not very well break up our camps and send the men home. It was done, however, in the Civil War, and some regiments of Southern troops were disbanded and sent home because of measles. Now we have got to work out some more satisfactory solution for taking care of streptococcus cases in a hospital than by refusing to take them in. It can be done, I think it is reasonable to believe, and by following out the recommendations which have been read here we will go a long step toward preventing cross infections in hospitals due to the streptococcus.

We must work out, in other words, in the medical wards, in the contagious wards, some method of isolation of patients from one another so that cross infections cannot occur. That has been done on the surgical side. It has been pretty easy to seal up a wound or to keep puerperal cases well separated. To keep and clean septic wards, we must apply that same thing on the medical side and the respiratory disease side of the hospital, and work out a ward technic for the protection of each patient against every other patient. Until we know whether a carrier who has a chronic tonsil is dangerous or not, we must protect everyone else in the ward against him.

Just how this is to be done is easy to picture, but I can see that it will be surrounded with many difficulties. In the first place, it will cost more, it will take more room. We cannot crowd patients in hospitals without getting cross infections. We must have abundant floor space, good ventilation, and, above all, a trained personnel and trained nurses.

In the meantime the bacteriologic examinations of these cases may show that some of them are unimportant and can be disregarded, but until that time comes the only thing we can do is to protect each man against every other man in the same ward.

We will have opportunities, I think, in civil life just as well as in the army during the war, to study out these problems:

perhaps better opportunities, because we were so swamped with the enormous number of cases that not everything that we wanted to do could be done, but we have at least learned some general principles to work upon, and in our children's hospitals, and especially in the nose and throat wards, this subject can be followed out. We can trace the natural history of streptococcus infection of the tonsil from month to month and from year to year. If we can find, each of us, a couple of chronic streptococcus carriers, and study them as long as they remain carriers without giving any treatment, we will learn the duration of the disease and whether secondary cases arise from those primary foci. That is a problem which must be solved before we will know exactly where we stand, and it can be done much better in our hospitals in time of peace than it could be done during the war.

I think that nothing which has come out of the war has been any better than this work on streptococcus infections. I think that now the field is pretty clear. We know what we are dealing with, we know what the problem is, and there is nothing to prevent us getting together and making a program and working it out through as many years as may be necessary to bring it to some satisfactory solution.

RECOMMENDATIONS.

The medical officers who have taken part in this symposium have agreed on the following recommendations in regard to the streptococcus hemolyticus carrier problem in the army:

I. Our knowledge of hemolytic streptococcus carriers is so incomplete that every effort should be made to answer the following questions:

(a) Are streptococci found in carriers all of equal importance, or are there different groups which differ in clinical significance?

(b) Is the chronic carrier dangerous to himself?

(c) Is the chronic carrier dangerous to others, or is the disease spread chiefly by cases or by case contact carriers?

II. In the absence of knowledge on these points, no final program for handling the problem can be stated, but a tentative program should be adopted which in case of doubt should err on the safe side.

III. When no streptococcus disease is present and in off seasons.

A. For soldiers in hospital. Incoming patients with throat infections should be cultured for hemolytic streptococci. Any positive case with diseased tonsils should have a tonsillectomy. Clean and infected measles wards should be maintained for practice in ward technic.

B. For soldiers in barracks. Clinical and cultural surveys should be made for the detection of chronic streptococcus infections such as tonsillitis and otitis media, which when discovered should be treated to remove possible foci of future epidemics.

IV. In the presence of streptococcus complications and during the streptococcus season.

A. In the hospital.

1. No carriers among attendants should be allowed in surgical wards or in wards with respiratory diseases.

2. A streptococcus isolation ward should be established to handle special cases.

3. Positive and negative measles pneumonia and nose and throat wards should be maintained with strict technic.

4. All admissions should be isolated until distributed to wards.

5. Throat cultures for hemolytic streptococci should be made on all admissions with respiratory diseases for record.

B. In barracks.

1. Recruits should be held for observation and cultured. Positive cases should be separated from negative as far as possible.

2. Clinical and cultural surveys should be made to pick out cases of tonsillitis, otitis media, sore throat which should be sent to hospital.

V. In the absence of exact knowledge and with due regard to military necessity, no attempt to isolate all streptococcus carriers is advocated at present.

XIX.

THE ROLE OF THE LABYRINTH IN FLYING EFFICIENCY—A STUDY OF 768 CASES AT THE THIRD AVIATION INSTRUCTION CENTER, ISSOUDUN, FRANCE, AMERICAN EXPEDITIONARY FORCE, FROM SEPTEMBER, 1918, TO JANUARY, 1919.*

By Henry Horn, M. D.,

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The history of the birth of new discoveries, or the application of old principles in a new and radical manner, is usually the same: the proponents of the new ideas see the millennium well within their grasp; the opponents endeavor savagely to tear down the pillars which support the new structure. Out of it all comes finally the truth—conservative minds which are not fired with the joys of discovery nor made exuberant by the strife, gradually sift out the best and give to the world that which can be used.

The battle which has raged around the turning chair and the value of the labyrinth in aviation does not concern us here. Suffice to say, it extended to two continents—and was acrimoniously debated by those who knew nothing about the subject as well as those who did.

The main reason why heretofore no satisfactory conclusion could be reached seemed to be that the discussions were largely academic in character, and the experimental work fragmentary and open to the objection of impracticability and of having stood the acid test of actual air experience.

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*This article was written from material gathered in the A. E. F. before access was had to work done in the U. S. The greater part of the detail otologic examinations were made by Capt. Claude Uren, M. C., to whom grateful acknowledgment is made.

The Medical Research Board, which was sent to the American Expeditionary Force, was ordered to the Third Aviation Instruction Center, at Issoudun, Indre, situated about 100 miles south of Paris; it was the largest training camp for American aviators in France.

From the time of the first examinations, in the middle of September, 768 aviators passed through the hands of the board, and not only were the cases studied from the standpoint of the otologist but the most thorough examinations were made from the ophthalmologic, internal medical, physiologic and psychiatric viewpoints as well.

We are concerned in this study mainly with the otologic side. The details of the findings of the other departments are to be found in other publications.

For several reasons these results are worthy of special consideration. The examinations were made by trained aviation medical men who had had large previous experience along exactly similar lines in the aviation camps in the United States. The aviators were under satisfactory conditions of military control, and an "esprit de corps" was early established by the flght surgeons and other men, in such a way that the Medical Research Board was freely consulted, and the men were without fear that tneir flying status would be jeopardized or shortened by our studies.

It was early seen that the work, from the otologic standpoint, would divide itself into two main groups: (1) Those aviators who complained of a hypersensitiveness to motion with disturbing labyrinth symptoms of various kinds which would in some way interfere with their flying; (2) those who gave no history of hypersensitiveness to motion but who, during routine examinations, were found to show labyrinthine findings which characterized the first group.

The hypersensitive to motion type, as we designated the men in these groups, with its characteristic symptom.complex, was naturally the most interesting, and it early developed that in this group a distinct history of sensitiveness to other forms of motion than that produced in chair and the air could be brought out, even before its presence was noted in their air work.

In drawing any conclusions from the results of these studies it must always be clearly borne in mind that on the one hand all the candidates had been examined previous to their admission into the service for hypersensitive labyrinths and the marked cases disqualified. On the other hand, it would be equally fallacious to consider that the hypersensitive men who came to our notice in the A. E. F. developed this hypersensitiveness after they entered the service, on the assumption that all men with 35 seconds or above, or 16 seconds or below, had been automatically cut out by the original entrance examination.

The hyposensitive cases proved to be surprisingly few and confirmed the belief that had been growing in the minds of most men experienced in this work that, given a properly functioning, well balanced labyrinth, low nystagmus time is a matter of very little importance.

Certainly we cannot get away from the practical fact that if a candidate goes through his training with honors, continues his flying without accident and is satisfactory to his instructors he can be regarded as a satisfactory type.

From this position only two conclusions are possible, if by chance we find that such men classed as satisfactory by the flying officers have abnormal labyrinthine findings: (1) Either such findings are of no value as far as efficiency goes, or (2) they have so accommodated themselves to the apparently hypersensitive labyrinth that it bears no relation to the quality of their air work.

Equally true is it that if the candidate appears before the board and complains of symptoms of hypersensitiveness in the air and the examination discloses the fact that he possesses a hypersensitive labyrinth, the conclusion is fair that the hypersensitive labyrinth plays a causal rôle in the matter.

Another side of the question which demands attention and which this work helped to solve is whether in the light of our recent experience the original labyrinth examinations for admission into the service were worth while and whether we should modify or omit such examinations in the future.

A proper appreciation and a fair analysis of the factors involved in these various groups will help us add a little knowledge to the question involved in the title of this article.

The material at the Third Aviation Instruction Center was unique, and the facilities for study were such that one could scarcely hope ever again to have a body of men of a certain definite type under such practical observation conditions. In the first place, they were men who had been culled out in the States, both physically and through the additional attritional grinding of the ground schools. They were all flyers of more or less experience and were eager to cooperate with the Medical Research Board. They were intelligent and took a keen interest in the results of the examinations. They were all working toward the same end, namely, to make themselves fit as quickly as possible for the great adventure of their lives. The results of a great group study of such a body of men should be dependable and should give us a very fair viewpoint of the rôle of the labyrinth in flying efficiency.

The Normal Type.—Much discussion has arisen as to what constitutes the normal or average labyrinth findings and whether our standards for the aviation candidate, more or less empirically selected in the very beginning of the aviation examinations, were too high or too low.

A compilation of results of the labyrinth findings, on more than 50,000 cases examined for admission into the aviation service, was made by the Statistical Bureau at Washington. It will be recalled that these examinations were made by men specially trained in chair work and all used a standard technic, must be accepted as nearly correct as lies within human possibilities. The very size of the aggregate, the fact that the results were obtained from different men in different parts of the United States, makes the average dependable.

In order to make our present study as free from criticism as possible, one examiner who had examined thousands of candidates in the States, made over 75 per cent of all the otologic examinations, and the results after final tabulation agree so closely with those given by the early examinations in America that the accuracy of both sets of statistics seems to be established.

There is a limit of accuracy in the observation of nystagmus time as well as a possible variation in all individuals from day to day, that makes it extremely questionable whether one is

ever justified in drawing conclusions from results where the difference does not exceed two seconds.

and past pointing are lowered by air work is not borne out by the following figures.

The opinion held by many investigators that nystagmus time

Table 1 is designed to give a birdseye view and summary of all the vestibular examinations made by the Medical Research Board in the A. E. F., and at the same time compares them with the results of the 50,000 cases examined in the United States. The right and left hand tests are grouped separately. All statistics were calculated on adding machines and the results checked. The following observations are allowable:

Nystagmus.—There is no appreciable difference between the right and left side. This is in accordance with the American statistics.

The apparent lowering of the men from the front is interesting but probably has no significance. It runs a little over half a second lower, as compared with the average run of men at the Third Aviation Instruction Center, but it is a little over a second higher than the general average given from the 50,000 candidates for admission into the Aviation Service at the beginning of the war. Our observations were made with extreme care and accuracy, one man examining practically all the cases, and frequent checkings would show less than a second difference between two observators.

The fact that the monitors, who were doing from four to six hours of flying a day at the time of the examinations, show no reduction, as against the average student, is the best evidence that the apparent lowering in the men from the front is of no significance.

Past Pointing.—Here there is very little difference between the various classes. The past pointing in the States is markedly higher, about 1.4 on the average. The ability to correct an exaggerated past pointing is rapidly acquired. In aviation students, all of whom have had chair or air experience, it is a matter of pride to accommodate themselves, consciously or unconsciously, to vertigo. This may be one reason why the general average was lower in the A. E. F., as it must be remembered that all of the men examined had had previous chair

experience, while the candidates in the States were having their very first sensation of vertigo due to turning.

Vertigo.—The average time of vertigo is given with no claim as to the value of this test. It was taken as part of the routine examination in connection with other observations and represents in a general way an average.

This test would at first seem to be subject to many inaccuracies. In fact, when taken with candidates for admission or those unaccustomed to peculiar forms of motion, its accuracy is doubtful; but in the testing of men who have had air experience, the comparison of results of the vertigo examinations, from day to day or from test to test, are strikingly constant. Repeatedly there would be no difference at all or perhaps the difference of less than two seconds, between two observations on the same individual on different days. The wide variations found in nonflyers is due to the confusion produced by the vertigo, to which they are unaccustomed and which militates against accurate subjective observation.

Table II is a separate study of the results of the same tests by months. It was thought worth while to see if, as the training progressed or if the terrific strain which the men were under in October and the early part of November when men were being forced through the school as rapidly as possible, had any influence on the labyrinth reactions.

The differences are all in fractions of a second or less than a complete past pointing and evidently represent no real differences due to the period of training or the effect of strain. The vertigo was 4.19 seconds greater in October than November, and again in December raised again to 19.2 seconds over 18.17 seconds, but I am loath to admit this has any real significance.

Table III is a regrouping of men from the front, monitors and the statistics from the United States, arranged to show the labyrinth reactions according to the group under study. It will be noted that the differences are remarkably small between the different groups. Exceptions in the case of the past pointing have already been spoken of.

The conclusion seems obvious that the amount of air work which these men have had, ranging in the case of students from an average of less than one hour a day, or a total of

thirty to fifty hours during their training, to the monitors who are in the air four to six hours daily, does not in any way materially lower their labyrinth reactions. It is equally obvious, judged from the practical standpoint of results achieved, that during the same period they accommodate themselves to new and unusual motion stimuli and are turned out finished flyers.

The mechanism of this accommodation to unusual forms of motion, of the rapid and complete compensation to the various forms of vertigo brought about by air conditions, is a question of great complexity and has nothing to do with study. A satisfactory explanation is not at hand, but it seems certain that it involves other factors than the simple accommodation of the labyrintth to new stimuli. We are certainly here dealing with a problem in which the psychologic and cerebral element plays an immense factor. Our studies along these lines are replete with human interest.

Every gradation of the ability of a hypersensitive labyrinth to accommodate itself for the requirements of successful flying has been met with. From the well known case of Captain Eddie Rickenbacker, the foremost of American aces, who in his early acrobatic work on the field was a very hypersensitive type—even to the point of vomiting—to the extremely rare type of student who, after his first experience in acrobatics, is willing to give up flying, we have encountered every phase. We are dealing with the unanalyzable phenomenon of "nerve"; and this is a factor which is difficult to subject to statistical examination.

With a large and generous quality of this typical American characteristic, many deficiencies can be overcome. On the other hand, fight it out as they may, some of the grittiest of the students were unable to overcome the handicap of a hypersensitive labyrinth and were obliged to discontinue or modify their training.

The exceptions do not prove the rule. These studies convince us that more than ever the original examinations were worth while. If we erred at all, it was on the side of too great leniency as far as the labyrinth examinations were concerned. The hypersensitive type is worthy of deep consideration and,

where recognized, should be admitted to the service with greatest caution.

At a conservative estimate 10 per cent of the men who passed through the board, from the standpoint of the labyrinth, would better never have been trained. The saving in lives, in time and in the fitting of round pegs into square holes, would have been worth while.

The Hypersensitive to Motion Type.—This term, although somewhat awkward, expresses exactly the condition of these men and is used throughout this article as fairly descriptive.

It is the type "par excellence," which comes within the region of labyrinth investigation and the solution and explanation of it can in a large part be explained by labyrinth findings.

As it subsequently developed it is unfortunate, that in the original examinations for admission to the service, more weight was not laid on the history of hypersensitiveness to motion. Candidates were originally asked if they had ever been seasick and if so how severely. In the light of our recent knowledge, as the following table will show, if the questions had been carried a little further much additional interesting information would have been obtained, and many of the truly hypersensitive cases could have been excluded.

The types of motion which were particularly investigated were: Seasickness, swings, merry-go-rounds, car sickness and air sickness due to motion of the plane.

The combinations which Table IV brings out are curious and show that a person is very seldom sensitive to one type of motion alone. There seems to be no one combination favored more than the others.

That this history of hypersensitive to motion, when carefully elicited, should be taken seriously in the selection of candidates, this is shown by the fact that of 76 cases, 40 were obliged to discontinue or modify their air career and that 17 or 22 per cent of them were grounded from this cause alone.

In studying the way in which their air work was modified by this condition, full access was had to the official reports of the flying records of these candidates. Table three is given in detail in order to bring out the remarks taken from such records.

Table IV is perhaps the most important one in this study.

All cases which came before the board and which gave a history of being hypersensitive to any sort of motion, whether they realized that it had affected their air work or not, are here analyzed.

In many of these cases two examinations have been made and the second examination on a later date serves to emphasize the difference in the findings taken on different days. Thus in case 268 there is a difference of almost ten seconds and in other cases even greater variations may be noted. It is to be remarked that case 268 was put on ferry work, which means, simply flying machines from one place to another, and in which the element of acrobatics is entirely eliminated, or in the case of 232 where the man was grounded because he was unable to do his work properly on the avro or acrobatic machines.

It will also be noted that the vertigo runs unusually high in cases and that this is often combined according to the column of remarks with either poor flying or reasons for grounding. In the column of falling reactions, a far greater proportion than usual are marked "exaggerated" (ex) markedly exaggerated (mark) or slightly exaggerated (S. E.)

Twenty-seven cases out of 57 are marked nauseated, which is over 47 per cent. Seven out of the group vomited during the test.

In the subsequent columns devoted to different types of hypersensitiveness motion "O" stands for negative answer and "Y" or "Yes" for positive answer. The men were quizzed very closely as to their experiences in merry-go-rounds (often designated as carousals), swings, trains and street cars, experiences on the sea, the results of their avro work, which was the airship used at Issoudun for trick flying and air acrobatics and finally were questioned regarding their experiences in air work in general.

Often these experiences dated from early childhood, as early as the fourth and fifth year, and the hypersensitiveness had been overcome up to the time they commenced their air work.

The questions were very carefully selected so that the ideas of hypersensitiveness would not be suggested to the candidate.

In the column of remarks, access was had not only to our

own very complete histories of the cases but to the official records of their flying filed at headquarters. In this way a final estimate of the true status of the student to his air work can be fairly well ascertained. And one gains the impression that in the 57 cases out of the 76 who were either grounded or discontinued their flying, it would have been far better if in the original entrance examinations greater attention had been paid to his history of hypersensitiveness to motion and the candidate disqualified even if the labyrinth findings fell within apparently satisfactory limits.

Table V is a summary of table IV. In this table we tried to find out if any one form of hypersensitiveness to motion was combined with any other form in an exaggerated proportion.

This does not seem to be the case, and furthermore it is shown that very seldom were the flyers susceptible to any one form of motion alone, without a combination of some other form. This does not hold for the air alone, for here a positive answer was given in five cases. Almost any discomfort which they experienced in their first flight was usually credited to dizziness.

Finally it is to be remarked that 27 per cent of this series were returned to full duty, while a little over 47 per cent were either grounded or were obliged to discontinue flying on account of hypersensitiveness. And of this latter number 17 or 29.08 per cent of the total were disqualified with the diagnosis of hypersensitive labyrinth.

Chart 6 is a record of 35 cases where there was absolutely no history of being hypersensitive to motion, but where in the routine examination a nystagmus of 30 seconds or more was noted.

As a matter of convenience, 30 seconds was selected as a lower limit of hypersensitiveness, because it was found that as many cases had the characteristic symptom complex of hypersensitiveness to motion between 30 and 35 seconds as did those above.

The remarks in this chart cover a wide range of subjects and were taken from our history of the cases. As far as can be judged ten of the 35 cases are normal (429, 229, 285, 276,

59, 473, 302, 386, 259, 368) and show that nystagmus as high as forty seconds (229) with a slightly exaggerated falling is not necessarily incompatible with good flying.

Case 429 with 36 seconds nystagmus, 4-5, 3-3, past pointing and 22 seconds vertigo was put in Class A.

In considering these ten exceptions, it must be borne in mind that there were ten such cases in nearly 800 men, so that as a class, men who have high nystagmus and still make good flyers are not particularly common.

The cases under chart 6, where their flying career was markedly modified and can be credited to the hypersensitive labyrinth are seven in number (6, 456, 381, 362, 849, 118, 188).

It is to be noted in the "Remarks" that in five cases focal or other infections are given credit for the labyrinth irritation. It is a point which in our experience is pretty well established, that local or general infections, the focal infections of the teeth, or the more common infection of influenza, certainly do temporarily increase the nystagmus time. During such temporary increases we have forbidden the men to fly, as many deaths are directly attributable to accidents, while the men are sick from partially recovered infective conditions.

Attention is called to cases 381, 345, 116, 245 where marked lowering of the nystagmus is obtained at a subsequent examination.

So important do we consider this point and so many marked cases occur throughout our studies, that we find it unwise in studying any pathologic case, to accept labyrinth findings unless they are taken under the same observational conditions at least a week apart.

In admission examinations also, we would think it only fair, where the history of hypersensitive to motion is at all doubtful and where the nystagmus time is excessive, not to disqualify the candidate without a subsequent examination a week later. A history of a cold or active infection would also demand a second examination after the trouble had cleared up.

The Subnormal Labyrinth. Chart VII.—As previously noted, these cases were extremely rare, but 14 with 16 seconds or below and but 2 with 13 seconds or below.

In the early days of the entrance examination in America the lower limit of 16 seconds was very closely adhered to while the upper limit was more elastic.

The majority of us, I think, have deviated widely from that original conception. Very little evidence of any kind has been produced that a hypersensitive labyrinth interferes with flying ability or that it dulls the perception of special localization and movement. We must have a perfectly intact, well balanced labyrinth and the lower limit is a matter of very little moment.

In this group of 14 cases, only one case was recommended for grounding on this cause alone (266). This was one of the very early cases and I have always felt that it was a mistake. In the other cases, the remarks give a hint as to why they appeared before the board and the connection with the hypersensitive findings is very questionable.

Monitors.—The monitors at the Third Aviation Instruction Center were a group of men who had been selected as flying instructors, because of their superior skill and experience as flyers. They had been culled out from the thousands of students who had passed through the school because they represented in every way the ideal American aviator. No medical examination had influenced their selection as monitors. It was the hard-headed experience of the heads of the flying departments—the fact that they had made good without accidents, that they were dependable, morally, physically and physiologically, that resulted in their selection for this important and dangerous work.

It is difficult to imagine where a finer group could be found for an intensive study of the American flyer under conditions of intense mental and physical strain. They were all eager to cooperate with the examinations, they were all actively engaged daily with hours of air work and were in the best physical condition possible. (But one out of the 110 was found physically unsatisfactory, the rest were normal.)

The supervision of this group study was under the control of Major Edwin Schneider, formerly professor of physiology at the University of Colorado, and elaborate studies were made of the rebreathing tests (the English tests for flying efficiency) and the physiologic, psychologic, psychiatric sides. The eyes were studied and the ears and labyrinth examinations were

made with great care. The results given in Table VIII speak for themselves.

Table VIII and the following charts give in detail the results of these investigations from the otological standpoint.

In passing it might be said that from the standpoint of the normal, ideal flier these statistics have never been equaled. In not a single case, not one of these 110 men deviated physically except one man who had just returned from active duty at the front and had been put on temporary monitor work.

In every single case the eye findings were normal and the men checked up normally from the physiologic and psychologic viewpoints.

Otologic Study.—There was no case in which the nystagmus exceeded 36 seconds. There was only one case in which the nystagmus fell below 16 seconds, on both sides (330). The lowest past pointing was 1-1, 328, 133, 378, 419). The highest 5-4 (384). The falling reaction was generally normal, in one case exaggerated and in one case subnormal. Their falling curves as shown on the self-registering joy stick was invariably normal. The vertigo was constantly low. No case of nausea or vomiting was noted. The averages are given in Table —. The only deviations from the normal for the eyes, the medical or psychiatric examinations are those given in the footnotes at the end of the table.

If this group study shows one thing, it shows that by natural selection men have finally become to be monitors, and that the unfit temperamentally and physically have fallen by the wayside. The terrible strain of the work, the accidents and natural elimination, has dropped the weaklings and the hypersensitive to motion type by the roadside.

If this group of men represents our highest type of air men, then certainly if his physical findings correspond exactly with the original ideal requirements for admission into the service, we may conclude that these requirements as laid down in the original 609 examinations, were very close to the ideal requirements.

One suggestion which was constantly made in America, was that practice would materially lower the nystagmus and other vestibular reaction time. The analysis in Table IX, as well as statistics previously given effectively disproves this theory.

Fields 2, 5, 8 and 9 were given over almost exclusively to instruction in acrobatics.

Some of these monitors were in the air five and six hours a day, doing various forms of air stunting, such as tail spins, turnings, loops, etc., certainly if we are to find the influence of constant movement in cutting down the nystagmus or influencing the other tests we would find it here.

Chart X is the detailed findings of the monitors by Fields. A comparison of these tables shows no constant variation. We are always forced back to the same conclusion that there is no evidence that actual flying conditions lower the labyrinth reactions, but that the general averages given in Table I represents the true status both as the experienced and nonexperienced flyers. The difference between the two groups is simply in their ability to adapt themselves to the vertigo and not have it interfere with their airwork.

The Men from the Front.—Naturally the one group which the Medical Research Board desired to study was that of the men who had been subjected to the actual strain of fighting.

In this we were somewhat disappointed as far as any far reaching effects in the way of staleness was concerned. Our boys were not subjected to the fearful strains that the English and French had to endure during the first three years of the war, and in addition many of them as can be seen by the following tables had but a few short hours over the lines.

The study of the 110 men here presented represents possibly one-tenth of the American aviators who were actually flying at the front when the armistice was signed, but our observation of these men who had actually had experience at the front with from 40 to 250 hours over the line leads us to the same inevitable conclusion. The general type is the same, the comparison of the labyrinth reactions shows no striking changes.

Table XI gives a detailed review of the labyrinthine findings in these men. In the column of remarks can be seen the hours over the lines and the number of their victories placed to their credit. We are impressed with the few whose nystagmus time go over 35 seconds, only one case on both sides.

One man (637) who was hypersensitive and could not have his test completed on account of the nausea had 29 to 30

seconds and 4 to 5 past pointing and was credited as an American ace.

The second, (655) with 31-36 seconds nystagmus, was also hypersensitive and brought down two planes.

A third (660) with 26 seconds was also nauseated.

The rest were all in the normal class. The three exceptions with no excessive nystagmus showed evidences of staleness and were temporarily indisposed.

If we refer again to the general summary given in Table I we note how closely these men approach the general average. More interesting, however, is the fact that when Table XI is studied in detail, we note as in the monitor group study an absence of the hypersensitive to motion type.

It is the striking normality of the successful type that interests us, a type which had to be picked out, as far as the labyrinth is concerned almost empirically at the beginning of the war. These statistics speak worlds for the accuracy and soundness of the original standards.

It is a matter of interest purely that we tabulate eight men Table XII examined by the Medical Research Board, who had brought down five or more enemies, thus putting them in the class of American aces.

Had the war lasted but a few months longer many names would have been added to this list. In a large measure they had opportunities that the other did not have.

In giving their findings we are taking no credit from them, when we show that they deviate in no essential particular from the other men we have examined. Their nystagmus time never reached 30 seconds and there are no hypersensitive types among them.

Conclusions.—1. In conclusion it might be said that the statistics for this paper were worked up with great care and exactness. The fact that we were dealing with the human organism had no place in the manner in which the examinations were conducted. The nystagmus was observed as carefully as possible, the past pointing and falling were accurately determined.

But when the cases are totaled and compared with the statistics from America, we again take into consideration the variability of the human element. The slight differences but

strengthen the belief that as a result of continuous air work—acrobatic work—monitor work or work over the lines the labyrinth reactions are not changed in any essential particular.

2. Among the select and the successful the hypersensitive to motion type are few and far between.

3. Many typical hypersensitive to motion types can accommodate themselves to this handicap and become successful.

4. A very considerable number of those who slipped through the entrance examinations or who were on the border line of the hypersensitive to motion type were not able to overcome the handicap and are dropped by the road side.

5. Given an intact and well balanced labyrinth—there is nothing to indicate that the lower nystagmus limit is of consequence even as far down as 13 seconds.

6. The normal labyrinth findings as previously determined is substantiated by our studies.

7. Special care should be exercised in allowing candidates with a hypersensitive to motion history and nystagmus around 30-35 seconds to enter the service. Thirty-five seconds is the extreme margin of safety.

8. With the great amount of material which America has to select from, no one should allow themselves to be influenced by the exceptions brought out in this paper.

9. Although almost any handicap of hypersensitiveness to motion can exceptionally be overcome why should we risk the possible serious consequences?

TABLE I.

Totals and General Summary.

NYSTAGMUS.

Totals of 842 cases (including monitors and men from front) nystagmus to right....24.32
Totals of monitors, 79 cases, nystagmus to right....24.40
Totals of men from front, 120 cases, nystagmus to right....23.61
Totals of men examined in States, over 50,000, nystagmus to right....23.00
Totals of 830 cases (including monitors and men from front), nystagmus to left....24.18
Totals of monitors, 78 cases, nystagmus to left....24.32
Totals men from front, 119 cases, nystagmus to left....23.77
Totals of men examined in States, over 50,000, nystagmus to left....23.10

PAST POINTING.

Totals of 818 cases (including monitors and men from front), P. P. to Rt.—Rt. hand.... 2.35
Totals of monitors, 79 cases, P. P. to right—right hand.... 2.27
Totals of men from front, 117 cases, P. P. to right—right hand 2.29
Totals of men examined in States, over 50,000, P. P. to right—right hand.... 3.8
Totals of 819 cases (including monitors and men from front), P. P. to right—left hand.... 2.31
Totals of monitors, 79 cases, P. P. to right—left hand.... 2.25
Totals of men from front, P. P. to right—left hand.... 2.20
Totals of men examined in States, over 50,000, P. P. to right—left hand.... 3.7
Totals of 614 cases (including monitors and men from front), P. P. to left—right hand.... 2.30
Totals of monitors, 78 cases, P. P. to left—right hand.... 2.35
Totals of men from front, 115 cases, P. P. to left—right hand. 2.22
Totals of men examined in States, over 50,000, P. P. to left—right hand.... 3.8
Totals of 811 cases (including monitors and men from front), P. P. to left—left hand.... 2.35
Totals of monitors, 79 cases, P. P. to left—left hand.... 2.34
Totals of men from front, 115 cases, P. P. to left—left hand... 2.32
Totals of men examined in States, over 50,000, P. P to left—left hand.... 3.7

VERTIGO.

Total of 555 cases (including monitors and men from front), vertigo....19 6
Totals of monitors, 79 cases, vertigo....17.1
Totals of men from front, 115 cases, vertigo....19.50

TABLE II.

Labyrinth Findings Arranged by Months.

SEPTEMBER, 1918.

Nystagmus, to right, 68 cases.....24.55
Nystagmus, to left, 67 cases.....25.10
Past pointing to right, with right hand, 67 cases..... 2.47
Past pointing to right, with left hand, 67 cases..... 2.43
Past pointing to left, with right hand, 68 cases..... 2.25
Past pointing to left, with left hand, 67 cases..... 2.18

OCTOBER, 1918.

Nystagmus to right, 119 cases.....25.24
Nystagmus to left, 111 cases.....25.41
Past pointing to right, with right hand, 112 cases..... 2.54
Past pointing to right, with left hand, 112 cases..... 2.35
Past pointing to left, with right hand, 110 cases..... 2.32
Past pointing to left, with left hand, 109 cases..... 2.43
Vertigo to the right, 114 cases.....23.33
Vertigo to the left, 36 cases.....22.36

NOVEMBER, 1918.

Nystagmus to right, 254 cases.....24.69
Nystagmus to left, 254 cases.....24.32
Past pointing to right, with right hand, 245 cases..... 2.41
Past pointing, to right, with left hand, 246 cases..... 2.35
Past pointing to left, with right hand, 243 cases..... 2.32
Past pointing to left, with left hand, 244 cases..... 2.32
Vertigo to the right, 245 cases.....18.17

DECEMBER, 1918.

Nystagmus to right, 202 cases.....23.18
Nystagmus to left, 201 cases.....23.25
Past pointing to right, with right hand, 198 cases..... 2.2
Past pointing to right, with left hand, 198 cases..... 2.27
Past pointing to left, with left hand, 197 cases..... 2.21
Vertigo, 196 cases.....19.2

TABLE III.

Labyrinth Findings—Comparison of Seasoned Fliers and Inexperienced Men.

MEN FROM THE FRONT.

Nystagmus to right, 120 cases	23.62
Nystagmus to left, 119 cases	23.18
Past pointing to right, with right hand, 117 cases	2.30
Past pointing to right, with left hand, 117 cases	2.20
Past pointing to left, with right hand, 115 cases	2.22
Past pointing to left, with left hand, 115 cases	2.32
Vertigo to the right	19.51

MONITORS.

Nystagmus to right, 79 cases	24.40
Nystagmus to left, 78 cases	24.34
Past pointing to right, with right hand, 79 cases	2.27
Past pointing to right, with left hand, 79 cases	2.25
Past pointing to left, with right hand, 78 cases	2.35
Past pointing to left, with left hand, 79 cases	2.24
Vertigo to the right	11.87

SUMMARY OF AMERICAN STATISTICS (OVER 40,000 CASES).

Nystagmus to right	23.00
Nystagmus to left	23.1
Past pointing to right, with right hand	3.8
Past pointing to right, with left hand	3.7
Past pointing to left, with right hand	3.8
Past pointing to left, with left hand	3.7

TABLE IV.

Table of Hypersensitive to Motion Type.

No.	Nystagmus		Past Pointing		Vertigo	Falling	Nausea	Vomiting	Turning
122	27-26		2-2	2-1	..	Ex.	O	O	O
	23-24	(10/28)	2-1	1-2	17	N.	O	O	O
128	23-35		5-5		..	B.	O	O	Y
130	25-30		4-3	3-4	..	Mark.	O	O	O
	25-30					T. B.			
131	27-26		.....		30	N.	O	O	Y
140	33-42		.....		..	Ex.	O	O	O
	32-40								
	24-31	23-35	....	(10/28)	..	Ex.			
145	27-28		2-2	2-2	38	Ex.	O	O	O
	25-27	(10/24)	.....		38	Ex.	O	O	O
148	27-25		3-2	2-3	25	Ex.			
158	23-30		.....		..	Ex.	Y	Y	Y
	22-28								
165	26-27		4-4	4-4	45	Ex.	Y	O	O
169	30-30		3-3	3-3	30	N.	O	O	O
179	33-35		2-2	2-2	30	N.	O	O	O
190	26-40		5-2	1-1	..	Sub.	O	Y	O
	25-40								
191	32-34		2-2	2-2	16-15	Sub.	O	O	O
202	16-17		1-1	1-1	15	Sub.	Sl.	O	O
	13-14	(10/25)	1-1	1-1	12-11	...	O	O	O
210	30-32		2-3	3-2	18	Sub.	O	O	O
227	32-30		3-3	3-3	25	Sub.	O	O	O
231	28-27		4-2	3-3	53	Ex.	Y	O	O
232	34-36		4-4	4-4	38	Ex.	Y	Y	Y
	11-42	40-42-	.....		36-36				
234	33-34		3-4	4-2	31	Ex.	O	O	O
237	13-15		T-1	1-T	10-9	Sl.	O	O	O
240	33-35		T-T	1-1	13-14	N.	O	O	O
247	20-20		3-2	2-3	20	Ex.	Y	O	O
	16-16	(11/14)			16	Ex.			
348	30-34		3-3	3-3	..	N.	O	O	O
87	23-24		4-3	3-4	23-20	Ex.	Y	O	O
101	30-30		3-3	3-3	25-25	Ex.	O	O	O

Arranged According to Symptoms.

No.	Sea-sick	Merry-go-r'nd	Swing	Car	Avro	Air	Remarks
122	O	O	Y	O	O	Y	Full duty
128	O	O	O	O	O	O	Hyper Laby. Class C.
130	Y	Y	O	O	O	Y	T. B.
131	O	Y	Y	O	O	O	Eye trouble
140	Y	Y	Y	O	Y	Y	Hyper. Laby. Class B.
145	Y	Y	Y	O	O	O	Class B. Eye.
148	Y	Y	Y	Y	O	Y	Observer
158	Y	O	O	O	O	Y	Grounded
165	Y	O	O	O	Y	Y	Full duty
169	Y	O	O	Y	O	O	Full duty
179	Y	Y	Y	O	O	O	Temp. unfit. Class C.
190	Y	Y	O	O	O	Y	Finally overcame trouble
191	O	O	O	O	Y	Y	Hyper. laby. Class B.
202	Y	Y	Y	O	Y	Y	Subnormal, with nausea
210	Y	Y	Y	Y	O	O	Routine after flu. F. D. Class A.
227	Y	Y	Y	Y	O	O	No stereoscopic V-Class B, E. and L.
231	Y	Y	Y	Y	Y	Y	Poor type but passed test
232	O	O	O	O	Y	Y	Grounded on avro work
234	Y	Y	?	O	Y	Y	Grounded on lab.
237	Y	O	O	O	Y	Y	Lack of conf. Ear?
240	Y	O	O	O	O	Y	T. B. Class C.
247	Y	Y	Y	O	Y	Y	Class C. Ears
248	O	Y	Y	Y	O	O	Full duty
87	O	Y	O	O	Y	O	Stopped flying at avro field
101	Y	O	O	O	O	Y	Class A.

TABLE IV—Continued.

Table of Hypersensitive to Motion Type.

No.	Nystagmus		Past Pointing		Vertigo	Falling	Nausea	Vomiting	Turning
347	24-17		1-T		25-25	N.	O	O	O
288	26-20		3-3	3-2	..	N.	O	O	O
	28-26								
521	26-24		4-3	3-3	22	N.	O	Y	O
168	22-22		4-5	5-4	37	N.	O	O	O
499	33-34		4-3	3-4	13	N.	O	O	O
372	20-18		2-2	1-2	23	N.	Y	O	Y
268	48-43	(11/5)	2-2	2-2	15	N.	..	..	..
	35-34	(11/8)	2-2	2-2					
265	30-30		5-4	4-5	35	N.	O	O	O
295	24-20		3-3	2-3	..	N.	Y	Y	O
	26-24								
254	35-32		4-3	3-4	22	N.	Y	O	O
354	30-24		6-4	2-2	24	Ex.	O	O	O
372	20-18		2-2	1-2	23	N.	Y	O	O
369	33-32		3-3	3-3	27	Ex.	Y	O	O
37	26-26		4-3	1-2	..	Mark.	O	O	Y
350	33-32		3-3	3-3	30	N.	Y	O	O
365	26-26		2-2	2-2	22	Ex.	Y	O	O
171	28-27		3-3	3-3	23	Ex.	O	O	Y
252	24-25		2-2	2-2	30	E.	Y	Y	Y
72	25-25		7-8	7-4	35-37	Ex.	Y	O	O
48	30-35		3-1	1-3	..	Mark.	O	O	Y
30	14-17		2-2	1-1	16-14	N.	Y	O	O
29	40-36		3-3	1-2	..	...	Y	O	O
26	31-35		3-2	2-2	..	...	Y	O	Y
4	35-36		3-3	3-2	..	Mark.	Y	O	O
1	21-21		2-2	2-3	..	Mark.	Y	O	Y
102	30-28		6-7	7-6	..	Mark.	O	O	Y
	30-30								
	26-27	(11/14)	3-4	4-3					
121	22-35		3-3	3-2	..	N.	Y	Y	O
	23-30								

Arranged According to Symptoms.

No.	Sea-sick	Merry-go-r'nd	Swing	Car	Avro	Air	Remarks
347	O	O	O	O	O	Y	Grounded-dipl. and deaf
288	O	O	O	Y	O	Y	Trouble due to conv. insu.
521	O	O	O	O	Y	Y	Class A. Overcome trouble
168	Y	O	O	Y	O	O	Full duty. Ear not cause
499	Y	O	Y	O	O	O	Class C. Hyper. laby.
372	O	O	Y	Y	O	Y	Class C. Temp. unfit
268	Y	O	O	O	Y	Y	Hyper. due to infection
265	O	O	O	O	O	O	Hyper. Ferry work
295	O	O	O	O	O	Y	Temp. cond. due to drink
254	O	O	O	O	O	Y	Full duty
354	O	O	O	O	Y	Y	Stop flying at avro.
372	Y	Y	Y	Y	O	Y	Stop flying. Temp. unfit
369	Y	Y	Y	Y	Y	Y	Full duty
37	O	O	O	O	O	Y	Flying record poor
350	Y	Y	O	O	O	Y	Full duty
365	Y	O	O	Y	O	Y	Class A
171	O	Y	Y	O	O	O	Discontinue training
252	O	O	O	O	Y	Y	Class A
72	O	O	O	O	O	Y	Class A
48	O	O	O	O	O	Y	Fly. rec.
30	O	O	O	O	O	O	Ferry pilot
29	O	O	O	O	O	O	Flying record poor. Fin. lashed from avro.
26	Y	Y	Y	Y	O	Y	Put on large machine
4	O	O	O	O	O	Y	Class A
1	Y	Y	Y	Y	Y	Y	Poor in avro. Final air work good
102	O	O	O	O	O	Y	To fly with caution
121	Y	Y	O	O	O	Y	Full duty

TABLE IV—Continued

Table of Hypersensitive to Motion Type.

No.	Nystagmus	Past Pointing	Ver-tigo	Fall-ing	Nau-sea	Vom-iting	Turn-ing
143	35-34	2-2 2-2	?	N.	O	O	Y
141	25-25	2-2 2-2	20-20	:	O	O	O
97	22-25	2-3 3-2	15-18	:	O	O	O
438	36-36	3-4 3-3	30	N.	O	O	O
259	30-29	2-2 2-2	18	S. E.	O	O	O
489	32-32	.....	14	..	Y	O	Y
416	34-33	4-4 4-4	30	Ex.	Y	O	Y
262	34-33	.....	23	N.	O	O	O
252	24-25	2-2 2-2	30	S. E.	O	O	O
342	26-26	3-3 2-1	20-20	N.	O	O	O
262	34-33	3-3 3-3	23	N.	O	O	O
265	30-30	5-4 4-5	35	N.	O	O	O
254	35-32	4-3 3-4	22	N.	Y	O	O
416	34-33	4-4 4-4	30	Ex.	Y	O	Y
354	30-24	6-4 2-2	24	Ex.	O	O	O
295	24-26	3-3 2-3	20-24	N.	O	O	O
456	36-34	2-1 4-4	29-19	:	O	O	O
2	28-28	3-3 3-3	23	N.	O	O	O
216	38-40	6-6 6-6	40	S. E.	O	O	O
423	34-35	2-4 2-4	24	N.	O	O	O
369	33-32	3-3 3-3	27	Ex.	Y	O	O
300	24-26	3-3 4-4	18	N.	O	O	O
297	25-23	.....	25	N.	Y	O	O
294	30-26	3-2 2-1	22	N.	O	O	O

Arranged According to Symptoms.

No.	Sea-sick	Merry-go-r'nd	Swing	Car	Avro	Air	Remarks
143	O	Y	?	O	O	O	Full duty
141	O	O	O	O	O	Y	Dizziness not due to ear
97	O	O	O	O	O	Y	Dizziness not due to ear
438	O	Y	O	Y	Y	Y	Never passed beyond avro.
259	O	O	O	O	O	Y	Dizziness not due to ear
489	O	O	O	O	O	O	Too nauseated to finish
416	Y	Y	Y	Y	Y	Y	Dis. training at avro.
262	Y	Y	Y	Y	O	O	Full duty
252	O	O	O	O	Y	Y	Full duty
342	Y	Y	Y	Y	Y	Y	Nothing in ear to acct. for hyper.
262	Y	Y	Y	Y	O	Y	Full duty, A
265	O	O	O	O	O	O	Ear has no inf. on gen. con.
254	O	O	O	O	O	Y	Air trouble, may be due to ear
416	Y	Y	Y	Y	Y	Y	Hyper. to motion. Class C
354	O	O	O	O	Y	O	Ear has no inf. on gen. con.
295	O	O	O	O	O	Y	Temp. condition. Class A
456	O	O	O	O	O	Y	Hyper. to motion. Class B
2	O	Y	Y	O	Y	Y	Slight hyper. Air work poor
216	O	O	O	O	Y	Y	Grounded
423	O	O	O	O	O	O	Hyper. due to F. I.
369	O	O	O	O	Y	Y	Local inf'n caused trouble
300	?	Y	Y	Y	Y	Y	Temp. condition. Class A
297	O	O	O	O	O	O	Neurocir. asthenia. Class C
294	O	O	O	O	O	Y	Temperamentally unfit

TABLE V.

Hypersensitive to Motion, 76 Cases.

SUMMARY OF TABLES.

Seasick, alone	0
Seasick, combined	34
Merry-go-round, alone	0
Merry-go-round, combined	31
Swings, alone	0
Swings, combined	26
Car sick, alone	0
Car sick, combined	21
Avro, alone	0
Avro, combined	27
Avro and air, alone	8
Avro, air and seasick	3
Air, alone	15
Air, combined	38
Number of cases to full duty or Class A	21
Number of cases grounded or discontinuing flying or training markedly modified	40
Number of cases grounded with diagnoses hypersensitive labyrinth	17
Vomited during tests	7
Eye preponderating cases	2

TABLE VI.

Cases with an Entirely Negative Hypersensitive to Motion History but with Nystagmus of Thirty Seconds or More.

No.	Nys.R.	P.P.	V.	F.	N.	Fly'g History	Remarks
5	33-30	3-3	....	Ex.	Y	Good	Mentally incomp. Class C
59	32-30	3-3 2-2	22-15	Mar.	Sl.	Fair	Class A
6	32-32	2-2 2-2	15-36	N.	..	Fair	Put on DH 4
117	35-33	3-4 4-3	....	N.	Y	Fair	Class B, conval. flu.
454	34-34	3-3 3-3	20-20	N.	..	No record	
456	36-34	2-1 4-4	20-19	Ex.	..	Good	No flying after exam.
473	32-33	2-2 2-3	23	N.	..	Fair	
302	35-34	3-3 3-3	40-36	Sl.	O	Fair to good	
423	34-35	2-4 2-4	24	N.	..	No record	Increase prob. due to infct.
386	33-34	3-3 3-3	20	N.	..	Good	Normal type
381	33-32	3-3 3-3	32	N.	..	Fair to good	No flying after Nov. 21
Dec.4	24-24	5-4 4-3	32	N.	..		
259	30-29	2-2 2-2	18	Ex.	..	.....	Trouble not in laby.
362	33-30	3-3 3-3	20	N.	..	Fair to good	No flying after Nov. 21
349	35-34	3-3 3-3	22	N.	..	Fair to good	To U. S. Dec. 7, '18
368	34-33	3-3 3-4	25	N.	..	Fair to good	Class A
118	35-35	4-2 2-4	17-17	N.	..	Medioc. pilot	Nerv. in air due to poor phys. cond. and incr. nys. and p. p. Lab. cond. did not const. import't factor
223	30-30	3-3 3-3	35	N.	..	Good	Shows with these findings no results on flying
412	35-34	3-3 3-3	30	N.	..	Fair to good	Incr. possible due to infect. No fly. after exam.
345	30-30	3-4 3-3	24	N.	..	Very poor	Prob. lab. cond. had nothing to do with disinclination to fly

TABLE VI—Continued.

No.	Nys.R.	P.P.	V.	F.	N.	Fly'g History	Remarks
Dec.2	25-25	2-2 2-2	35	N.	..		
105	30-30	2-2 2-2	12-12	S.N.	..	Good	Call attention to 30 nys. and low vert. and subnor. falling
104	32-30	2-2 2-2	15-15	N.	..	.... ..	Quoted to show nys. of 30 and above may give noth. subnor. Note vert. and p. p. not above.
166	36-36	3-1 1-3	22	N.	..	Fair to good	Type where high nys. has no bearing on history.
116	37-33	2-2 2-2	26-25	N.	Y	Good	Note dec. of irritability and incr. of hearing after removal of focal infection
Nov.22	30-33		24-25				
268	48-43	2-2 2-2	20	N.	Sl.	Good	Focal infect. prob. had something to do with nys.
245	34-35	3-3 3-3	25	Sl.	..	No record	Possible that some passing cond. may have incr. the nys. temp., but 2nd ex. shown nys. norm. Nothing in hist. to indicate hyper. lab.
Nov.7	26-27	3-3 3-2	25	..	..		
178	30-30	3-2 2-3	27	N.	..	Good	Type of normal man with 30 seconds
429	36-36	4-5 3-3	22-20	N.	..	.....	Class A
64	30-30	3-3 3-2	18-20	Mark.	..	....	Vacation with conv. exerc. Report to eye dept. before fly.
142	30-30	4-5 5-3	30	Exag.	..	.....	Type with rather high nys.
285	34-34	3-3 3-4	20	N.	..	Good	Nothing in hist. to show effects of high nys.
276	30-27		22-20	N.	..	Good	Class A
429	36-36	4-5 3-3	22-20	N.	..	Poor to fair	No hyper. to motion hist.
229	38-40	3-2 2-2	25	Sl. Ex.	Y.	Good	Full duty
Oct.28	38-38	6-6 4-4	25	Ex.	..		
188	32-33	3-3 3-3	20	Sl. Ex.	..	.....	Taken off fly., trans. to hdqt.
154	35-35		35-35	N.	..	Fair	Refer. to Tbc. hosp.

TABLE VII.

Cases With Sixteen Seconds or Below.

No.	Nys.R.	P.P.	V.	F.	N.	Fly'g History	Remarks
290	16-18	T-T 1-1	10-11	N.	..	Was at front	Held by eye dept. Not classified
286	16-10 17-12	1-1 1-1	....	N.	..	Very good	Class B, chronic indigestion. Bad focal infection teeth and tonsils
266	13-14	2-1 T-T	19	None	..	No record Fair	Recom. as laby. below par that he be put on observer work
305	15-15	1-2 1-1	10-12	N.	..	.....	Class B—needs goggles
243	16-12	T-T 1-T	20	N.	None	Good	Low nys. did not interfere with flying
27	16-16	1-1 1-1	....	N.	..	Fair	Return to active duty
230	15-15	1-1 2-2	20	N.	..	Very good	Quoted to show possibility of lowering nys. by constant turnings
156	15-15	1-1 1-1	5	N.	..	.....	Class C, chronic rhinitis vasomotor
149	16-16	2-1 1-2	15	N.	..	None	Class B, temp. unfit
12	17-15	2-2 2-2	....	Subnor. and ex.		Fair	Trans. to Chief of Air Service
102	16-17	1-1 1-1	15	N.	Y	Good	Ferrying
Oct.25	13-14	1-1 1-1	12-11	N.	..		
37	15-15	T-1 1-T	10-9	Sl.	..	Fair	Class C, shunt from vestibular to vagus
247	20-20	3-3 2-3	20	Ex.	Y	Fair	Class C. No theory for this unless shunting theory through vagus and hyper. verticals
Nov.14	16-16		16	Ex.	Y		
30	14-17	2-2 1-1	16-14	N.	..	Prim.very poor	Ferry pilot

TABLE VIII.

Summary of Labyrinth Statistics, Taken From Major Schneider's Monitor Study.

ANALYSIS OF LABYRINTH FINDINGS ON 77 MONITORS, AT THE THIRD A. I. C.

No.	Hours	Nys. R.	Nys. L.	P.P.R.	P.P.L.	Fall.	Vert.
1		21	20	2-2	2-3		
66	60	20	20	2-2	2-2	N.	
71	30	21	23	2-2	2-2	N.	
105	120	30-3	30	2-2	2-2	Sub.	12-12
303	200	20	22	1-3	3-1	N.	34
311	500	28	24	3-3	3-3	N.	16
315	120	16	17	2-2	2-2	N.	4-4
316	100	22	24	2-2	3-2	N.	12
317	200	24	23	3-3	2-3	N.	15
318	400	28-30	30	3-2	2-2	N.	15
324	70	22	20	2-2	2-2	N.	20
325	120	24	23	2-3	3-2	N.	10
328	325	15	16	1-1	1-1	N.	12
329	450	22	24	2-2	3-2	N.	16
330	20	12	11	1-1	1-1	N.	8
331	750	26	26	3-3	3-3	N.	17
332	200	18	17	2-2	1-2	N.	5
333	400	16	17	1-1	1-1	N.	6
334	200	22	23	2-3	3-2	N.	16
335	206	22	24	2-2	3-2	N.	12
336	150	30	28	3-5	2-3	:	20
337	4,500	20	20	2-3	3-2	N.	20
338	550	23	22	3-5	2-2	N.	5-5
339	200	22	24	2-2	3-2	N.	20
340	180	20	20	3-3	3-3	N.	24
341	250	22	23	2-2	2-2	S. E.	2
348	500	26	25	3-3	3-3	N.	8
349	300	35	34	3-3	3-3	N.	22
350	130	35	32	3-3	3-3	N.	30
351	250	22	23	1-1	1-1	N.	16
352	250	23	24	3-2	2-3	N.	12
352	230	23	24	3-3	3-2	N.	10
41	325	25	26	3-3	3-3	N.	28
356	300	25	25	2-2	2-2	N.	25
357	200	25	25	2-2	2-2	N.	28
358	200	25	24	2-2	2-2	N.	22
359	140	20	22	2-3	3-2	N.	14
361	150	19	17	2-1	2-2	N.	24-25
362	60	33	30	3-3	3-3	N.	20
363	60	35	27	3-3	4-3	N.	20
366	200	22	22	2-2	2-2	N.	14
367	200	26	26	2-2	2-2	N.	27
376	150	22	21	2-2	3-2	N.	16

TABLE VIII—Continued.

No.	Hours	Nys. R.	Nys. L.	P.P.R.	P.P.L.	Fall.	Vert.
377	40	20	19	2-3	3-2	:	20
378	102	16	16	1-1	1-1	:	12
379	200	23	24	2-2	2-2	:	15
383	45	26	26	2-2	2-2	:	22-22
384	150	36	30	5-4	4-5	:	28
385	300	27	28	2-2	2-2	:	15
386	800	33	34	3-3	3-3	:	20
387	150	25	25	2-2	2-2	:	22
388	200	26	25	2-2	2-2	:	12
389	500	30	30	3-3	3-4	:	22
39	100	26	26	2-1	1-2	:	19
391	390	30	30	3-1	1-3	N.	29
56	111	25	20	2-4	3-1	:	23-22
417	200	26	26	2-2	2-2	:	20
406	350	26	26	2-2	2-2	:	15
419		28	27	1-1	1-1	:	20
420	400	30	30	2-2	2-2	:	19
430	250	26	26	3-3	3-3	Ex.	15
405	175	26	26	2-2	2-2	:	20
403	100	26	26	3-3	3-3	:	22
122		27	26	2-1	2-2	:	17
404	250	28	29	4-2	2-4	:	20
418	150	18	20	2-2	2-2	:	22
431	350	20	19	2-2	3-2	:	6
364	200	24	26	3-3	3-2	:	18
471	340	22	20	3-2	2-3	:	12
472	80	30	30	3-3	3-3	:	26
473	225	32	35	2-2	2-2	:	23
474	200	26	26	2-2	2-2	:	18
475	400	22	21	2-2	2-2	:	14
483	89	20	21	2-2	3-2	:	18
491	200	25	25	3-4	3-3	:	25
514	160	27	28	2-2	3-2	:	22

Cases are given by number only:

Examinations made between September 16, and November 27, 1918.

Lowest age, 20; highest age, 30; No. 420 was 20 years; No. 418 was 30 years.

All general physical examinations showed normal findings except No. 430, classified B for general physical instability.

All eye examinations normal.

All nasal examinations normal except No. 105, tonsil operation advised. No. 317, advised nasal treatment. No. 333, deviated septum. No. 351, deviated septum operation advised when convenient.

Neurologic examinations all normal as to personality. No. 419 stale; No. 122 not aggressive.

TABLE IX.

Comparison of Reactions of Monitors from Various Fields.

NYSTAGMUS TO THE RIGHT.

Monitors, 79 cases, all fields, nystagmus to right, 24.40.
Monitors, 9 cases, field 8, nystagmus to right, 26.6.
Monitors, 5 cases, field 9, nystagmus to right, 21.8.
Monitors, 10 cases, field 5, nystagmus to right, 22.5.
Monitors, 29 cases, field 2, nystagmus to right, 25.1.

NYSTAGMUS TO THE LEFT.

Total of 78 cases, all fields, nystagmus to left, 24.32.
Monitors, 9 cases, field 8, nystagmus to left, 26.4.
Monitors, 5 cases, field 9, nystagmus to left, 21.6.
Monitors, 10 cases, field 5, nystagmus to left, 22.8.
Monitors, 29 cases, field 2, nystagmus to left, 24.3.

PAST POINTING, RIGHT.

Monitors, 79 cases, all fields, P. P. to right, with right hand, 2.27.
Monitors, 9 cases, field 8, P. P. to right, with right hand, 2.6
Monitors, 5 cases, field 9, P. P. to right, with right hand, 2.0.
Monitors, 10 cases, field 5, P. P. to right, with right hand, 2.2.
Monitors, 29 cases, field 2, P. P. to right, with right hand, 2.3.

Monitors, 79 cases, all fields, P. P. to right, with left hand, 2.25.
Monitors, 9 cases, field 8, P. P. to right, with left hand, 2.4.
Monitors, 5 cases, field 9, P. P. to right, with left hand, 2.2.
Monitors, 10 cases, field 5, P. P. to right, with left hand, 2.3.
Monitors, 29 cases, field 2, P. P. to right, with left hand, 2.4.

PAST POINTING, LEFT.

Monitors, 78 cases, all fields, P. P. to left, with right hand, 2.35.
Monitors, 9 cases, field 8, P. P. to left, with right hand, 2.4.
Monitors, 5 cases, field 9, P. P. to left, with right hand, 2.4.
Monitors, 10 cases, field 5, P. P. to left, with right hand, 2.2.
Monitors, 29 cases, field 2, P. P. to left, with right hand, 2.5.

Monitors, 79 cases, all fields, P. P. to left, with left hand, 2.34.
Monitors, 9 cases, field 8, P. P. to left, with left hand, 2.6.
Monitors, 5 cases, field 9, P. P. to left, with left hand, 2.0.
Monitors, 10 cases, field 5, P. P. to left, with left hand, 1.9.
Monitors, 29 cases, field 2, P. P. to left, with left hand, 2.3.

VERTIGO.

Monitors, 76 cases, all fields, vertigo 17.9.
Monitors, 9 cases, field 8, vertigo 23.2.
Monitors, 5 cases, field 9, vertigo 17.0.
Monitors, 10 cases, field 5, vertigo 15.3.
Monitors, 29 cases, field 2, vertigo 16.7.

TABLE X.

Monitors—Taken by Fields.

FIELD 2.

No.	Date	Name	Hours	Nys.	P. P.	Vert.	Falling
105	10- 1-18	D. H.	120	30-30	2-2 2-2	12-12	Subnorm.
315	10-15-	G. E. S.	120	16-17	2-2 2-2	4-4	Norm.
316	10-15-	J. H. T.	100	22-24	2-2 3-2	12	Norm.
323	10-15-	H. B. H.	120	24-23	2-3 3-2	10	Norm.
328	10-14-	R. M. B., Jr.	325	15-16	1-1 1-1	12	Norm.
329	10-14-	W. J. R.	450	22-24	2-2 3-2	16	Norm.
330	10-14-	R. B. M.	80	12-11	1-1 1-1	8	Norm.
332	10-14-	B. M. W.	200	18-17	3-2 1-2	5-3	Norm.
334	10-13-	T. L. D.	200	22-23	2-3 3-2	16	Norm.
335	10-13-	J. P. M.	200	22-24	2-2 3-2	12	Norm.
336	10-14-	R. S. D.	150	30-28	3-5 2-3	20	Norm.
337	10-14-	H. F. D.	4,500	20-20	2-3 3-2	20	Norm.
339	10-14-	W. E. R.	200	22-24	2-2 3-2	20	Norm.
340	10-14-	R. C. G.	180	20-20	3-3 3-3	24	Norm.
341	10-14-	J. R. W.	250	23-23	2-2 2-2	22	Sl. Exag.
348	10-15-	F. W. H.	500	26-25	3-3 3-3	8	Norm.
349	10-15-	H. W. S.	300	35-34	3-3 3-3	22	Norm.
350	10-15-	J. W. A.	130	33-32	3-3 3-3	30	Norm.
352	10-15-	H. O. F.	250	23-24	3-2 2-3	12	Norm.
362	10-18-	W. E. C.	60	33-30	3-3 3-3	20	Norm.
363	10-18-	G. V. W.	60	26-27	3-3 4-3	20	Norm.
364	11-18-	W. M. W.	200	24-26	3-3 3-2	18	Norm.

TABLE X—Continued.

No.	Date	Name	Hours	Nys.	P. P.	Vert.	Falling
471	11-18-	J. B. S.	340	22-20	3-2 2-3	12	Norm.
472	11-26-	B. F. C.	80	30-30	3-5 3-3	26	Norm.
473	11-26-	J. P. M.	225	32-33	2-2 2-2	25	Norm.
474	11-26-	W. W. R.	200	26-26	2-2 2-2	18	Norm.
483	11-26-	E. A. G.	90	20-21	2-2 3-2	18	Norm.
491	11-27-	R. G.	200	25-25	3-4 3-3	25	Norm.
514	11-27-	C. P. M.	160	27-28	3-3	22	Norm.
			FIELD 3.				
311	10-11-18	A. M. B.	500	28-24	3-3 3-3	16	Norm.
361	10-11-	S. F. A.	150	19-17	2-1 2-2	24-25	Norm.
366	10-18-	B. H. B.	200	22-22	2-2 2-2	14	Norm.
367	10-18-	R. S. O.	200	26-26	2-2 2-2	27	Norm.
383	10-20-	W. R. B.	45	26-26	2-2 2-2	22-22	Norm.
389	10-20-	G. D. F.	500	30-30	3-3 3-4	22	Norm.
404	11-20-	A. J. R.	250	28-29	4-2 2-4	20	Norm.
440	11-22-	H. L.	400	30-29	3-3 3-3	20	Norm.
			FIELD 5.				
71	9-26-18	R. R.	30	21-23	2-2 2-2	..	Norm.
303	10-11-	C. S. G.	200	20-22	1-3 3-1	34	Norm.
317	10-13-	L. L. H.	1,200	24-23	3-3 2-3	15	Norm.
318	10-13-	H. E. W.	400	28-30	3-2 2-2	15	Norm.
324	10-12-	H. C. M.	270	22-20	2-2 2-2	20	Norm.
331	10-14-	W. J. H.	750	26-26	3-3 3-3	17	Norm.
333	10-14-	W. S.	400	16-17	1-1 1-1	6	Norm.

TABLE X—Continued.

No.	Date	Name	Hours	Nys.	P. P.	Vert.	Falling
338	10-13-	F. W. M., Jr.	550	23-22	3-3 2-2	5-5	Norm.
351	10-15-	J. E. M.	250	22-23	1-1 1-1	16	Norm.
353	10-15-	L. M. D.	250	23-22	3-3 3-2	10	Norm.
			FIELD 8.				
66	9-24-18	I. D. F.	60	20-20	2-2 2-2	..	Norm.
41	10-16-	D. K.	325	25-26	3-3 3-3	28	Norm.
356	10-16-	W. D. H.	300	25-25	2-2 2-2	25	Norm.
357	10-16-	H. B. S.	200	25-25	2-2 2-2	28	Norm.
358	10-16-	A. P. F.	200	25-24	2-2 2-2	22	Norm.
359	10-16-	S. E. L.	140	20-22	2-3 3-2	14	Norm.
384	10-20-	V. D. H.	150	36-30	5-4 4-5	28	Norm.
385	10-20-	G. S. V.	300	27-28	2-2 2-2	15	Norm.
386	10-20-	J. H. C.	800	33-34*	3-3 3-3	20	Norm.
391	10-20-	L. H. S.	390	30-30	3-1 1-5	29	Norm.
			FIELD 9.				
376	10-19-18	H. W P.	150	22-21	2-2 3-2	16	Norm.
377	10-19-	J. C. P., Jr.	40	20-19	2-3 3-2	20	Norm.
378	10-19-	C. E. R.	102	16-18	1-1 1-1	12	Norm.
379	10-19-	B. M.	200	25-24	2-2 2-2	20-22	Norm.
403	10-19-	R. H. Mc.	100	26-26	3-3 3-3	22	Norm.

TABLE X—Continued.

FIELD 10.

No.	Date	Name	Hours	Nys.	P. P.	Vert.	Falling
387	10-19-18	R. B. V.	150	25-25	2-2 2-2	22	Norm.
388	10-19-	S. E. D.	200	26-25	2-2 2-2	12	Norm.
390	10-20-	J. K. N.	100	26-26	2-1 1-2	19	Norm.
56	10-19-	J. C.	110	25-20	2-4 3-1	23-22	Moderate
417	10-20-	P. V. A.	200	26-26	2-2 2-2	20	Norm.
406	10-20-	H. L. B.	350	26-26	2-2 2-2	15	Norm.
419	10-20-	W. T. B.	...	28-27	1-1 1-1	20	Norm.
420	10-19-	J. W. E.	400	30-30	2-2 2-2	19	Norm.
430	10-20-	G. A. B.	250	26-26	3-3 3-3	15	Exag.
405	10-30-	T. V. L.	175	26-26	2-2 2-2	20	Norm.
122	9-30-	I. J. H.	...	27-26	2-1 2-2	17	Norm.
418	11-19-	G. P.	150	18-20	2-2 2-2	22	Norm.
704	12-19-	A. E. G.	300	30-30	1-1 1-1	15	Norm.

FIELD NOT GIVEN.

431	11-25-18	D. M. Y.	550	20-19	2-2 3-2	6	Norm.
475	11-28-	W. E. W.	400	22-21	2-2 2-2	15	Norm.
18	11- 9-	J. Q. K., Jr.	38	....	..	..	Norm.

TABLE XI.

Summary of Labyrinth Findings, Taken From Major Schneider's Study of Men From the Front.

No.	Hours	Nys. R.	Nys. L.	P.P.R.	P.P.L.	F.	V.	Hours over lines	Enemies shot down
487	350	20	20	2-2	...	N.	21	243	0
490	300	20	20	2-2	2-2	N.	17	250	0
492	300	25	25	2-2	2-2	N..	31	180	0
512	230	26	26	3-2	2-3	N.	18	150	5 Of.
513	300	25	25	3-2	2-3	N.	25	0	0
516	450	24	24	3-2	2-3	N.	15	40	0
531	250	31	30	3-4	3-5	N.	25	200	1
532	290	26	26	2-1	1-2	N.	18	215	0
534	300	25	24	1-1	1-1	N.	16	200	5½
535	300	16	16	1-1	1-1	N.	12	200	0
536	500	27	27	3-3	3-3	N.	28	200	1
537	80	20	20	3-4	3-3	N.	9	...	0
546	325	26	28	3-3	3-3	N.	26	185	4½
547	350	22	22	1-2	2-2	N.	15	0	0
552	150	20	20	2-2	2-2	N.	15	30	0
561	350	27	28	1-1	1-1	N.	11	0	0
562	300	22	24	2-2	2-2	N.	16	0	0
563	175	22	23	3-2	2-3	N.	18	0	0
566	200	25	25	3-3	3-3	N.	19	0	0
567	250	27	26	2-2	2-2	N.	5	0	0
568	250	15	15	1-2	2-1	..	15	52	0
569	120	25	25	2-2	2-2	N.	20	45	0
570	240	20	25	2-2	2-2	..	13	80	0
571	200	20	22	1-1	1-1	N.	14	75	0
572	120	20	21	2-2	2-2	N	15	2	0
573	300	22	20	1-1	1-1	Sub-N.	12	76	0
574	150	27	29	3-4	3-3	N.	25	8	0
577	200	30	31	3-3	3-3	N.	22	50	1
578	160	22	20	2-2	2-2	N.	17	12	0
579	350	28	28	4-4	4-2	N.	20	75	0
580	225	17	19	2-2	2-2	Sub-N.	32	80	0
581	210	22	24	2-2	2-2	N.	20	50	0
582	150	25	25	3-3	3-3	N.	20	0	0
583	125	16	16	1-1	1-1	Sub-N.	15	35	1
584	250	27	25	3-3	3-3	N.	20	60	1
585	150	26	26	4-4	4-4	..	18	60	0
586	250	26	28	3-3	3-3	N.	25	0	0
587	140	26	26	3-2	2-3	N.	12	21	1
591	110	28	27	3-3	3-3	N	22	50	2
592	250	25	27	2-1	1-2	N.	22	69	1
596	300	22	24	2-2	2-2	N.	17	120	0
597	325	23	24	1-1	1-1	N.	13	40	0
605	150	24	24	3-2	2-3	N.	26	40	1
607	200	20	21	3-3	2-2	N.	27	0	0
533	175	24	23	2-2	2-2	N.	19	125	0
588	200	22	22	3-2	2-3	N.	17	90	9 Unof.

TABLE XI—Continued.

No.	Hours	Nys. R.	Nys. L.	P.P.R.	P.P.L.	F.	V.	Hours over lines	Enemies shot down
613	300	28	31	3-4	3-2	N.	23	70	2 Of.
619	700	21	20	2-2	3-3	N.	14	40	4 Of.
620	125	25	26	2-1	3-2	N.	12	0	0
621	450	25	27	3-3	3-3	N.	21	40	2 Of.
622	450	25	27	2-2	3-3	N.	13	400	4 Of.
623	275	18	15	2-1	1-2	N.	12	120	5
625	350	26	28	2-2	3-2	N.	12	112	6 Of.
635	800	21	22	2-1	1-2	N.	15	0	0
624	650	30	29	2-2	2-2	N.	20	50	2 Of.
637	250	29	33	4-5	...	..	28	115	5 Of.
639	175	21	20	2-1	1-1	N.	12	60	2 Unof.
640	250	13	14	1-2	3-2	..	15	100	6
641	1000	24	26	2-2	2-2	..	14	60	2 Of.
642	200	20	20	2-2	2-2	N.	12	84	3
643	200	27	29	1-1	2-1	..	15	100	1
645	275	23	23	3-4	2-2	Sub-N.	18	200	2 Of.
646	250	21	21	1-2	2-2	..	13	80	0
647	350	32	32	2-2	2-2	..	27	70	5
650	250	24	26	4-4	4-5	N.	31	180	2
653	250	18	20	2-2	2-2	N.	10	63	11
654	200	28	24	2-2	2-2	N.	13	140	2
655	250	31	30	2-2	3-3	..	32	100	2
656	212	26	26	2-2	2-2	..	15	100	0
657	200	26	26	2-2	2-2	N.	18	95	0
658	200	18	17	3-3	3-3	..	35	110	0
660	200	26						120	1 Ball'n
661	300	22	22	2-2	2-2	N.	20	40	0
663	200	20	20	2-2	2-2	..	15	100	0
664	300	30	30	3-3	3-3	..	45	100	8
665	225	26	26	2-2	2-2	..	12	25	0
666	150	20	20	2-2	2-2	..	15	10	0
667	100	37	38	3-3	3-3	N.	25	0	0
668	175	26	26	2-2	2-2	..	24	54	1 Of.
669	120	27	28	3-3	3-3	..	30	26	1 Of.
670	300	18	19	1-1	1-1	..	10	150	*1
671	250	20	18	2-2	2-2	..	10	100	†1
672	325	16	17	1-1	1-1	N.	15	50	3 Unof.
673	250	18	18	2-1	1-2	..	14	125	0
675	300	20	20	3-3	3-3	S.L.Type	35	105	‡3
676	450	28	27	3-3	3-3	Hyper.	30	250	2 Of.
677	250	31	27	2-3	2-2	N.	26	130	0
678	120	31	30	2-2	2-2	N.	22	33	2
679	110	30	29	2-2	2-2	..	15	0	0
680	375	30	27			..	29	100	0
681	180	18	18	1-1	1-1	..	17	75	2 Of.
682	300	30	32	3-3	3-3	..	22	0	0
683	250	27	25	2-2	2-2	..	16	135	6 Of.
685	300	24	23	2-2	2-3	..	18	100	7 Of.
687	350	22	22	3-2	2-2	..	20	154	3
688	250	17	18	2-2	3-2	..	22	55	4

TABLE XI—Continued.

No.	Hours	Nys. R.	Nys. L.	P.P.R.	P.P.L.	F.	V.	Hours over lines	Enemies shot down	
691	200	37	35	4-3	3-4	..	21	100	0	
692	160	24	22	2-1	1-1	..	12	110	5	
693	190	26	26	3-3	4-4	..	19	105	4	
694	210	24	24	2-2	3-2	N.	16	120	6	
695	200	25	25	3-3	3-3	N.	20	60	4	
696	225	22	22	2-2	2-2	N.	12	80	6	
697	300	21	21	3-2	2-2	Sub-N.	20	160	6	
699		25	25	3-3	3-3	..	25	40	1	
701	85	28	28	4-4	4-6	N.	28	12	0	
707	180	26	26	2-2	2-2	N.	20	25	2	Of.
708	300	22	23	2-2	3-2	N.	29	...	5	Of.
714	100	20	20	1-1	1-1	N.	15	31	3	
716	250	20	20	1-1	1-1	None	25	30	2	
717	200	11	12	2-1	0-1	N.	11-13	100	3	Of.
718	280	22	22	4-3	4-3	N.	..	60	5	Of.
719	100	20	22	3-3	3-2	N.	..	15	3	
720	150	16	16	1-1	1-1	N.	..	42	1	Of.
721	200	19	16	2-2	2-2	N.	14-15½	70	4	Of.
723	250	18	19	2-2	3-2	N.	16	0	0	
725	400	20	20	2-2	2-2	N.	15	60	2	Unof.
Jan. 3	200	20	20	3-2	2-3	N.	23	..	.....	

*1 official; 2 unofficial. †1 official; 1 unofficial. ‡3 official; 2 balloons.

Numbers refer to history numbers.

All these men were examined between November 27, 1918, and January 3, 1918. The ages varied between 19 and 31.

The medical examination in all cases was normal except as follows: 512. Not fit to fly, "B." 531. Heart not fit. 561. Suggest Class "B." 577. Pus in urine. 591. Needs rest. 597. Class "B." 533. Not fit. 645. Stale now. 650. Stale, B. 655. Not fit to fly. 658. Needs rest. 660. Not fit, "B." 661. Not fit to fly. 666. Cardiovascular instability. 672. Class B. 673. Not fit, "B." 675. Needs rest. 680. Needs rest. 688. Stale. 699. Unfit, "B." 701. Unfit.

All eye findings were normal except 592, B Class, and 721, unfit.

The ear findings were all normal except 512, not fit to fly, "B," chronic rhinitis; 568, frontal sinusitis, radical operation four years ago. 581. Tonsillitis, "B," chronic enlarged cervical glands. 637. Hypersensitive, "C"; tests not completed on account of nausea; does not feel fit. 655. Hypersensitive, nausea and vomiting, hypersensitive to motion. 658. Slightly hypersensitive, slight nausea, probably stale. 660. Hypersensitive, could not complete turning, has been sick at stomach for several days. 661. Not fit to fly; bronchitis, infection posterior sinuses. 666. Tonsils, septic. 667. Hypersensitive; exaggerated falling, nausea. 670. Should have tonsils removed; septic tonsils. 671. Not fit; ethmoiditis acute. 676. Stale; hypersensitive to turning motion; stale; uren. 717. Slightly subnormal, in labyrinth findings, no indication that it affected flying.

Neurologically and from personality study all O K or of A type except: 561, not fit; 578, not fit; 580, stale; 596, stale, B; 597, stale, B; 624, stale; 650, B.

TABLE XII.

STUDY OF AMERICAN ACES

No.	Date	Name, Rank and	Age	Hrs.	Nys.	P. P.		Ver.	Fall.	Remarks
512	11-29	Buckley, Capt.,	22-8	230	26-26	3-2	2-3	18	Normal	Not fit
625	12- 9	Stovall, 1st,	23-9	350	26-28	2-2	3-2	12	Normal	Normal
637	12- 7	Seerley, 1st,	22-1	250	29-33	4-5		28	.....	Normal
640	12- 9	Guthrie, 1st,	22-7	250	13-14	1-2	3-2	15	Normal	Normal
675	12-14	Luff, 1st,	22-5	300	20-20	3-3	3-3	35	Sl. hyp.	N'ds rest
708	12-19	Healey, 1st,	24-8	300	22-23	2-2	3-2	29	Normal	Normal
534	12- 3	Oliver, 1st,	23-8	300	25-24	1-1	1-1	16	Normal	Normal
567	12- 2	Clark, 2nd,	20-8	250	27-26	2-2	2-2	5	Normal	Normal

XX.

ORGANIZATION OF THE SECTION OF DEFECTS OF HEARING AND SPEECH.*

By Charles W. Richardson, M. D.,

Division of Physical Reconstruction, Surgeon General's Office,

Washington.

When the Division of Physical Reconstruction was first created, it was known as the Division of Special Hospitals and Physical Reconstruction, under the administration of Major Edward King. One of the constituent sections of this Division was the section of blind and the defects of speech and hearing. This section was to be under the directorship of Major James Bordley, who was assigned from the section of surgery of the head, Division of Surgery, for this purpose.

On September 15, 1918, it was suggested by Lieut. Col. Theo. Lyster, the Chief of the Section of Head Surgery, that Major Chas. W. Richardson collaborate with Major James Bordley, taking charge of the section of defects of speech and hearing. Immediately after Major Richardson's designation for work in the field, he called a meeting of several representatives of the deaf, and physicians interested in this work, to a meeting to be held in Washington on Saturday, September, 1918. Present at this meeting were Miss Amelia N. Berry, representative of the New York School for the Deaf; Dr. Pervical Hall, president of the Columbia College for the Deaf; Dr. Max A. Goldstein of St. Louis and Major Chas. W. Richardson.

After a thorough consideration of the plans of organization and methods to be adopted, a scheme of the plan was left for Major Richardson to formulate and present to Major James

*Read before the American Otological Society at Atlantic City, June 16, 1919.

Bordley for the consideration of Major King. The principal idea conveyed in this connection was:

1. Consideration of the methods of the physical treatment of the defects of hearing and speech at the front.

2. The reeducation of the deaf and the correction of the speech defects.

(a) At the front immediately after the injury or disease.

(b) Transportation from the front to the interior districts where the reeducation could be begun, or transportation to America, where the reeducation could be carried on under better circumstances and to greater advantage.

3. It was decided that in reeducation in the near or completely deaf, one method should alone be followed—that is, speech reading. It was admitted that there possibly would be a few to whom the manual method would have to be given.

4. After a thorough consideration, the Muller-Walle system was adopted. It was suggested that the Nitchie method should not be overlooked.

5. Teachers: Those at the meeting seemed to think it would be impossible to obtain enough teachers to meet the demands. It was decided, therefore, to suggest a method of educating teachers for the work that was thought to be in view. It was decided that teachers should be between the ages of twenty-five and forty-five years.

6. In connection with speech defects, attention was called to the fact that a number of these defects would probably be traumatic in origin, and therefore would require a certain amount of plastic restoration before the speech correction, through teaching, could be instituted.

7. Rehabilitation: The consideration of this important feature in connection with these defects, especially of hearing, was thoroughly considered. The submission of these tentative plans was followed by a request from Major James Bordley, requesting an elaboration of the plan suggested by this committee. This was followed by a communication to Col. Edgar King, attention of Major James Bordley, subject, Reconstruction of the Deaf.

In this communication it was suggested that an attempt should be made for a thorough canvass of the teachers of lip reading of the United States.

It was suggested that the physical treatment in connection with the defect of hearing and speech be carried out as completely as possible before the return of the patient. It was considered advisable that all methods of reeducation should be done in the United States. Very definite reasons were given why it was not thought feasible to start the reeducation abroad:

(a) The soldiers needing this treatment could not be properly selected and segregated abroad.

(b) The place and environment for the teaching of the defective soldiers would be unfavorable.

(c) The difficulty of maintaining proper supervision of reeducational work of this type abroad.

(d) The adding of our burdens abroad by the prolonged maintenance of useless combatant elements in foreign lands.

(e) The great additional expense and the difficulty of obtaining competent teachers for service abroad.

It was suggested that reeducation of the defects in hearing and speech could be done within the walls of the United States Army General Hospitals, but attention was called to the fact that this work could be much more easily or ideally done in a specially created home or institution, which is solely devoted to this purpose.

A thorough discussion of the methods of educating and training cadet teachers for the work in hand and the expense incident thereto was detailed.

Attention was called to the necessity of vocational reeducation for some of the deaf. It was pointed out that shops would be required, and the necessity for the creation of an adequate vocational force to meet these requirements was emphasized.

Attention was called to the fact that the public employment agencies and the industrial organizations throughout the country must be convinced that the deaf are not abnormal people, but are perfectly normal beings who have substituted one sense for another in which they have been handicapped.

In this connection attention was called to the fact that the Rucker bill, now before Congress, had in consideration the establishment of a bureau in the Department of Labor, for assisting in the information of employers about deaf workingmen, and to help the latter to obtain employment.

To this was appended a communication from Major Blair with regard to the plastic correction of maxillofacial injuries. This communication laid dormant for a period of nearly five months. No action, either positive or negative, was taken in regard thereto.

During a greater portion of this time, from October 25th to March 11th, Major Chas. W. Richardson was acting as Chief of the Section of Otolaryngology in the absence of Major H. P. Mosher. The Division of Physical Reconstruction was undergoing its organization in many of its departments, and there seemed to be very little interest in the Section of Defects of Hearing and Speech. During this period, the subject of this section and its future activities was under our consideration. Investigation had led us to change our views with regard to certain important features in connection with the former communication sent to Major James Bordley. The number of probable patients did not seem so great as we had been led to believe. Most all statistics obtainable were at fault and disagreed. The nearest information that we could obtain was that there would be about 2 per cent of defects along these lines in all casualties. From the fact that the American registrants were subject to a more rigid physical examination, and that certain types of cases were entirely eliminated from the service, led us to believe that the number of defects in the American army would not be over 1 or even ½ of 1 per cent. It was thus evident that our whole plan of organization could be built upon a different basis.

We found, after a systematic investigation at the source, that a number of teachers could be obtained for speech reading and corrective speech work. We also found that these teachers were more than willing to give up their occupations to enter into the service. We, therefore, considered it absolutely unnecessary to even consider the question of educating a class of teachers to enter into this service.

On March 1, 1918, Major Richardson was notified by Lieut. Col. Edgar King that he was to assume charge in the Division of Special Hospitals and Physical Reconstruction, and was advised that he immediately acquaint himself with the details of the work, to separate the section from Major James Bordley's work in connection with the blind, and that he proceed to

make plans for the proper organization of the section.

On March 8, 1918, official orders were received, relieving Major Chas. W. Richardson from his duties in the Section of Otolaryngology, as soon as he could complete his duties, and assigning him to the Reconstruction Division.

Major Richardson reported for duty March 11, 1918.

Immediate steps were taken for the purpose of obtaining a personnel of teachers in lip reading. As a result of this effort, thirty-two teachers applied for service under army regulations; twenty-three teachers applied for service within their immediate vicinity; and twenty-six applied for service under various stipulations. A similar method was adopted in connection with the teachers for the defective in speech.

The securing of vocational instructors for the deaf was taken up. The hospital situation, as well as the proposed staff for each hospital, which is to be correlated with this work, was carefully considered.

An organization is planned and outlined as follows:

ORGANIZATION

OF THE

SECTION OF TREATMENT OF DEFECTS IN HEARING AND SPEECH

IN THE

DIVISION OF SPECIAL HOSPITALS AND PHYSICAL RECONSTRUCTION.

Medical Staff.—One Director in office of Section, Division of Special Hospitals and Physical Reconstruction; one Director for service abroad; one medical officer to classify cases at point of debarkation, rank of Major; one Major, one Captain, two Lieutenants, at Hospital No. 11, Cape May, N. J.; one Captain, one Lieutenant, at Hospital No. 2, Ft. McHenry, Baltimore, Md.; one Captain, one Lieutenant at Hospital No. 9, Lakewood, N. J.; one Major, one Captain, one Lieutenant, at teaching headquarters.

Civilian Staff.—One civil or sanitary officer as office assistant; one stenographer.

Teachers: One principal instructor, to have charge of all of the instructors at teaching headquarters. Five lip readers. These with the principal are to be employed as soon as the first

teaching center is established, and placed in order. Five vocational instructors. Two instructors, with practical knowledge of music, for instruction in musical rhythm and amusement. One masseur. One drill sergeant.

The question of compensation forms no element in connection with the employment of the medical staff in the reconstruction of the defective in hearing and speech as a result of the war, but it does with regard to all the civil employees.

It must be essentially recognized that most of the teachers to be employed by this division are individuals who have, after considerable study and expense, fitted themselves for a highly specialized type of teaching. The mental efforts to maintain practice and impart their knowledge are very great and exhausting. Their compensation in the private practice of their art is correspondingly remunerative; therefore, in the light of these facts it becomes necessary for us to consider carefully and thoughtfully the salary to be given these individuals. The compensation must be sufficient to dignify the position and enable the teachers to maintain themselves in befitting manner. From the fact that all of the individuals requiring reconstruction are males, and as most if not quite all the teachers are female, and as all of the teaching is to transpire during the daylight hours, it seems therefore expedient that the teachers be permitted to domicile themselves at other places than the actual teaching center.

Vocational teachers: The deaf soldier will find it probably impossible to follow his former active occupation in life. He will be obliged to readjust himself according to the degree of his physical handicap. In order to fit himself for a new vocation, which he is required to acquire to place him among the respecting wage earners, it becomes necessary to have vocational teachers to instruct him to acquire knowledge of that industry to which he can apply himself without being inconvenienced by his permanent handicap. Having prepared a list of vocations suitable for these handicaps, in which this handicap is a negligible quantity, we must seek and obtain the necessary corps of vocational teachers to meet the exigencies. These vocational instructors should, as the teachers above indicated, be compensated in proportion to the value of their services.

Speech Defects: Amusements.—An essential feature in the training of the defects in speech is not only the amusement feature of music, but also the important psychologic feature as well as the physical restoration of the voice obtained thereby.

Teachers: Many of the deaf will require teachers to train their voices. There will return many wounded soldiers whose defects of speech will result from the injuries and resulting contraction about the face and air passages. These will require masseurs and teachers specially skilled in reducing contraction, and as aid in the proper restoration of the spoken language. As a result of shock injury, many modifications of voice, nontraumatic in character, will be brought under our observation. Under the class we will note the stammerers and other modifications of voice. We will also have many deaf whose control of voice will require restoration. The treatment of returned soldiers afflicted with these disorders will require highly specialized teachers for this work. These teachers should be under the supervision of one or more medical officers who are experts along this line of medical therapeutics. These teachers should have the same general consideration as the teachers to be employed in lip reading.

Compensation for Civil Employees: The principal instructor should have a compensation of two thousand to twenty-four hundred dollars a year ($2,000 to $2,400 per annum). The teaching staff should be compensated according to their expertness, from twelve hundred to fourteen hundred per year ($1,200 to $1,400 per annum). Musical instructors should be compensated at the rate of twelve hundred dollars ($1,200) per annum. Masseur should receive compensation of twelve hundred dollars ($1,200) per annum. Vocational instructors should receive compensation according to the character of instruction they give and their efficiency. We should be guided in this work largely by what is usually regarded as a proper salary for these workers—from twelve to eighteen hundred dollars ($1,200 to $1,800) per annum.

Curriculum: In establishing the department of defects in hearing and speech, insofar as it is elementary teaching in its character, there will be required such regular pedagogic rules as prevail in all institutes, with the corresponding discipline

As all of our students will be soldiers, the maintenance of discipline should be very simple.

It is proposed that an intensive course should be pursued in teaching, but not of such high tension as to cause mental fatigue to the pupils.

The period of study, before the pupil is fully prepared for discharge as a finished lip reader, or defects of speech corrected, should not entail a period on the average of over six months. During this period of instruction for the deaf, and correction of speech defects, especially for the former, there is at the same time a course of vocational reeducation to be carried out. Thus we shall have not only insured the handicapped the privilege of social and business intercourse with his fellows, but have him also partially or complete reeducated.

The Course: All educational work should be undertaken in the forenoon. All vocational work in the afternoon. Advanced students during their vocational work will be able to practice their new found art.

The Deaf: The class work should be divided into three groups.

Lip Reading: (a) Lessons by trained teachers. This work should be carried out as individually as possible, each teacher having one pupil at each lesson. The number of pupils may be increased to four. One hour for each pupil or group. (b) Practice: This work can easily be carried out in groups. (c) Class work: Commencing at nine, each pupil could have three hours of work before the noon hour. The work will necessarily proceed in a circular method, and the pupil will necessarily have a different teacher for instruction. The vocational instruction for the deaf is to be given in the afternoon hours. In the evening, moving picture views of lip reading may be given to supplement the daytime work.

Defects of Speech: The correction of defects in speech is not attended with the same mental effort and consequent fatigue that is attendant upon lip reading. Therefore, the afternoon hours may be employed for this purpose, the morning hours being employed in the vocational training for all of those who require or request reeducation.

Time Required of Teachers: Each teacher should be able to do five hours' work a day. Through the system which we

have in view, three of these hours should be devoted to the teaching of soldier pupils, two of them to the training of cadets. Each teacher available should be able to teach from three to twelve soldier pupils per day. It would be well to employ a few cadet teachers, who could be taught by the trained teachers in the afternoon hours. In the forenoon they should be employed in practice work with the students. These cadet teachers need receive only a nominal pay during the period of cadetship. Through this method the probable necessary increase of teachers, as the war progresses, can readily be made. We have now in view, already pledged, twenty-four lip reading teachers, for service according to army regulations, prepared to go where their services are required. We also have twenty-five teachers in lip reading, willing to accept service at their own homes, and twenty-two willing to accept service under army regulations during school vacation, and other restriction. Enough from these classifications could be obtained to give us sufficient teachers to meet all our demands during the first year of military activities.

Numerous applications have been received of individuals who are both able and willing to become cadet teachers. Most of these women are intellectual and give promise, if accepted, of making fine teachers on the completion of their cadetship.

A list of teachers for the defects in speech is now being prepared and when completed will also show as favorable results as for lip readers. There are two important features which we must take cognizance of in connection with the work: First, the color question, which affects the defects in both classes; secondly, the inability of a very few to acquire the lip method of communication.

The color question can be solved, as it has been in educational work elsewhere, by segregation of patients and employment of teachers from northern states for the negro. The second question will only form an element of consideration after the teaching center has been established for several months. Those who are too obtuse to acquire the oral method, after demonstrating their incapability, may be transferred to other quarters where the manual alphabet is taught. In teaching the manual method, a high degree of qualification is not necessary in the teachers. The great disadvantage of the

manual method is that it does not permit the totally deaf to communicate with others unless they are conversant with the method.

Vocations.—A small number of those made permanently deaf, through war casualty, may, through reeducation, be enabled to follow the vocation which they pursued previous to their entering into the service of the United States Army.

A larger number, through defect in hearing, will be cut off entirely from their previous occupation, and this requires vocational retraining. It is well to remember that, in all of those already trained in vocations which are silent and without motion, that reeducation is hardly necessary. In the above mentioned occupation it is simply necessary to impress upon the employer the fact that a deaf individual is not an abnormal but a normal person, capable within a certain minor restriction of seeking and being able to take care of employment. The new types of employment which are opened to those deaf to the ears, but reeducated so as to hear with the eyes, are varied and numerous. Two methods of occupation are offered, viz.: First, the outdoor occupation; secondly, the indoor occupation.

Vocations in which the deaf should be reeducated are as follows, viz.: Indoor occupation—Printing, engraving in all of its branches, lithographing, bookbinding, chemistry, mechanical dentistry, draughting, photography and its allied arts, sign painting, house painting, interior decorating in all of its branches, shoemaking, saddling, cabinetmaking, wood working, artificiary in iron work, broom and mattress making, bookkeeping, electricity, engineering, plumbing, typewriting, library catalogue.

Out-of-door Occupation: Carpentry, bricklaying, scientific agriculture, scientific gardening, horticulture, mechanical and other work in garages, construction work, coopering, tin working and masonry.

A letter notifying each candidate for the position of teacher that his application has been received and that further instruction might be expected was mimeographed and forwarded.

A building in Baltimore has been selected as the appropriate place for the location of the teaching institute for the defects in hearing and speech, but as time dragged on without the con-

summation of the lease the proprietors became impatient. Every effort was made to expedite the lease through the War Department and to steady the impatient owners but both efforts resulted in failure.

The plan of organization as detailed above presents theoretically very many attractive features, but when it come to the practical application of the work in hand it was found that certain modifications had to be made. In order to bring in unison the activities of this organization with the various teachers of the deaf, and in order to get their cooperation, a number of the prominent educators were consulted. The necessity of considering the suddenly acquired deafness obtained in military service as being entirely different from the gradually acquired deafness in civil life was pointed out. It was shown that the line of reeducation was one that could only be carried on in an institution that was organized and designed solely for the teaching of the defect of hearing and speech. The type of work that was being carried on by the teachers in large institutions was not the type of teaching in reeducation that was necessary for these men. It was readily indicated and established that these men would not be satisfied by being treated at an established deaf and dumb institution. The only method to be employed to gain the confidence and support of the soldiers was either in a United States Army General Hospital or at a hospital designed for this purpose.

A diagnostic card which was to be entered up and form a part of the medical history of the patient was prepared. This card received the acceptance of the Division, but in some way it was apparently lost. Copy of this diagnostic chart had already been sent by United States General Hospital No. 11, and it was used there for the purpose for which it was intended, although it had never been printed in the proper form. A copy of the chart is herewith shown—Exhibit No. 1—as well as instructions which were to accompany the card. The chart as prepared for printing was afterwards found in the desk of an officer who had gone overseas.

After many plans had been suggested for the employment of an educational staff, the following plan was approved. In order to adequately start the work, an authorization was given for the employment of: One superintendent, at $3,000 per

year; one principal, at $1,800 per year; eight teachers, at $1,000 per year.

After this authorization, the question of appointing the teachers as head reconstruction aides at $60 per month, with rations and quarters, was suggested and accepted. This pay was more than the equivalent of the $1,000 which had been allowed, and removed the question of employment from the hands of the Civil Service.

In April, 1918, Capt. John Ingersoll was assigned to General Hospital No. 11, in otolaryngology, at surgical resident in charge of the Section of Defects of Hearing and Speech.

It had been our intention and desire to start this work in a special hospital devoted to the treatment of reeducation and rehabilitation of the defects of hearing and speech. Authorization for such purposes was not obtainable.

A well constructed and readily adapted summer hotel on the western outskirts of the city of Baltimore had been offered and accepted. It had every advantage that one could conceive for such an institution, excepting in one that it was not fireproof. After considerable delay the Hospital Division's request for the renting of this institution was approved by the General Staff, but just before being approved by the General Staff the owners withdrew the offer.

As a result of the failure to secure the Mount Holly property in Baltimore, the Hospital Division designated General Hospital No. 11, Cape May, N. J., as temporary quarters for the Section of Defects of Hearing and Speech until Mt. Holly became available, authorized April 23, 1918.

On account of the limitations placed on the Director of the Section, as a result of not being able to obtain the proper institution for this work, and as the Director of the Division of Physical Reconstruction seemed anxious that the work should be done in United States Army Hospitals, the necessity of enlarging the staff, both here and in the Surgeon General's office, in the hospitals and abroad was necessarily restricted.

The Hospital Division was particularly anxious that this section should have all the advantages of an independent hospital existence; should have an institute of its own; should have a staff of otolaryngologists in this institute and the gen-

eral advantages which would accrue from an independent existence. It would improve more rapidly and be under less limitations if they were entirely free from the surroundings and general depression of a United States Army General Hospital.

As a result of this, many places were offered for hospital purposes which were small and seemingly very attractive, both in location and in physical characteristics, that would lend them to this purpose. We spent much time in inspecting the various places offered, but we found none acceptable. While many of the places donated for hospitals were attractive, others are wholly unsuitable, and would require a large sum of money to remodel them into the necessary type of building which we thought essential to do this work. So nothing along this line, after various arduous trips, could be found that would answer the purpose. Most of them were large summer residences of very rich people, but frequently inappropriate places for hospitals, and to a certain extent inaccessible; none of which could be converted for hospital use except under large expense. In some cases this expense would be borne by the individual owners of the property, and others would have to be borne by the United States Government. Several large funds were offered to finance this sectional work in connection with this hospital, but all that were investigated had some conditions attached which made it impossible to even consider them. We had the satisfaction, though, of diverting a couple of these funds toward channels that would prove profitable to all. All work in connection with individual hospital sites for various reasons therefore proved unsuccessful, and at last we were obliged to open up our work in a very satisfactory quarter and under the most satisfactory conditions at United States Army General Hospital No. 11. The commanding officer, Colonel Paul Straube, was an enthusiast in any endeavor which this section proposed to start in United States Army General Hospital No. 11.

On July 23rd, at 7 p. m., there was inaugurated at General Hospital No. 11 the opening of the school for the treatment of defects of hearing and speech. This ceremony was attended by the staff, patients of the hospital and visitors. The opening address was made by Colonel Paul Straube, the command-

ing officer. It was followed by a few remarks by the Director, Lieut. Col. Charles W. Richardson, as to the scope of the work and the methods of treatment. The address of the evening was made by Major W. W. Keen of Philadelphia, the subject being "Observations on the Difference Between the Medical Treatment During the War of the Rebellion and Those of the Present Day."

On July 24th the treatment was inaugurated with seventeen patients in attendance.

All patients were examnied in the Otolaryngology Section of the hospital by the staff under the direction of Major John M. Ingersoll. They were all tested out and their conditions noted as entirely satisfactory. The complete deaf, of whatever character, were immediately assigned for special reading. The near deaf, and those having deafness in both ears under 5/20, in which the condition of the ears indicate that the hearing would become progressive, although gradually worse, were assigned to the speech reading department.

Most of the cases we found had some degree of impairment of hearing before entering the service.

It is interesting to note that up to the period of December 31, 1918, we never saw what could be accurately designated socalled shell shock deafness. We have seen two cases that bear very close resemblance to shock concussions—that type of cochlea injury which is attendant upon those exposed to hours of intensive gunfire in which high explosive shells predominate.

The course which we adopted in speech reading was of the individual instructive type. Each patient was given one-half hour instruction twice daily at the beginning. We found that two study periods a day were about sufficient for most men. They were given mirrors to study their own lip movements, and they were also given practice among each other. In fact, we found them very assiduous in their efforts toward improvement, anxious to gain all the advantages that could accrue from intensive work.

It is interesting to observe that all our white patients are fairly bright boys, who had recently become intensely deaf, not possessing any other type of injury, and were more than anx-

ious to remove this one handicap so as to be restored to normal. In the early days of our work we found there were a few recalcitrants, but later on, as all new patients would see the value of the method as examplified in other patients in all gradations of improvement, they became anxious to undertake the treatment.

Independent of the speech reading work, we found that there were certain conditions which presented themselves among our patients, such as illiteracy among some of the Americans and the naturalized foreign born. Illiteracy existed also among most of our native negroes. We also found that some foreigners could not pronounce the English language properly and had a very limited vocabulary. There not being enough work for our Aides in speech correction, we decided to give the illiterates an opportunity of removing this handicap. It is astonishing with what rapidity our Aides, not only in the defect of hearing but also in corrected speech work, removed this impediment. Men who could neither read, write nor figure, would acquire elements of speech reading with a week or ten days, and then we would begin on them with the three R's, and usually a week thereafter we would have them writing, reading and doing simple problems in addition, subtraction, division and fractions.

I herewith exhibit the work of a foreigner, named Warschoefsky, and secondly, a negro named Chas. Morris. We had French, Spanish and other nationalities, with whom I could hardly converse on account of the difficulty of understanding their broken English. These were put on the phonetic training, and within a short period, a week or ten days, we not only had them pronouncing English, but also increasing the limits of their vocabulary. The limitation of our work in speech correction is very marked. Of course we have so few patients come to us in this line. We have had a number of aphasics. It is real interesting to see how our Aides in corrective speech work progressed with these aphasics and how readily they improved.

On September 20th, the following definition was made in regard to the disposition of patients reaching the stage when they will be ready for classification for either discharge or be retained in limited service:

"All patients who are nearly deaf—that is, below the normal register for acceptance into the service previously as recruits, and who have become proficient in lip reading, should be placed in Class 'C,' limited service, for employment only in motionless activities.

"Those men whose hearing is reduced below 75 per cent of normal, with deafness acquired in line of duty, who have become proficient in lip reading but still hear very loud sounds, should be put in Class 'D,' without limitation as to motion or motionless activities.

"Those patients who have more or less marked impairment of hearing, near or complete deafness, who still have a disease of the ear in the form of suppuration, or dry ears which will suppurate from time to time, however proficient in lip reading they should become, should be discharged from the service.

"Those patients who, from want of concentration or from intellectual inability, cannot acquire proficiency or near proficiency in lip reading, and who have to depend upon other methods of communication, after due effort has been made on our part, should be placed in Class 'D.'"

It was interesting to find that, contrary to expectation of some of the teachers of the deaf, we have had no case that required the manual method of teaching. Even cases of the most unpromising character, seemingly of the lowest type of mentality, have acquired the speech reading art with unusual facility.

One man, an apparent wreck, came into the United States General Hospital No. 11, without any history and without any papers. There was nothing known of him excepting that his name was Soloman. Where he came from and where he was to go, no one knew. He was deaf and dumb. The only effort of speech during the first two or three days was attended with considerable stammering, which made it impossible to understand that which he wished to say. The aide who was attempting to bring his defective organs into life could make out what he stated in these efforts. Ten days atfer this man entered the hospital, and our aides had had him under their direction, he was reading and writing, but his spoken words still were articulated with difficulty. Later we found out from another patient, who had been in the same hospital with him when

abroad, that he was considered to be demented. This case was classed as psychoneurotic. That the man was deaf before he left the vessel at Brest there is no doubt from the patient's own statement. He also gave convincing evidence from an incident that occurred to him when in Brest that he must have been deaf at that time. Also there is no evidence of his having ever been exposed to high explosive shells. Within a few days after he had been in the hands of our aides we obtained from him his name and home address, and two weeks after his entrance into the hospital he gave an account of his whole history, from the time of his entrance into the service until his return to United States Army General Hospital No. 11.

Apreciating the fact that there would be in all probability a certain number of cases coming into the hospital who could be improved and whose hearing probably could be restored through resorting to the auricular method of training, we gave this subject a most thorough consideration.

After examining the various methods which had been adopted by the various Allies in connection with this work, we decided that the auricular method, in which the human voice was employed, offered the most logical method: it seemed as though it should give the best results. This is the method which seemed to be used most extensively in the various French hospitals and institutions to which the deaf are assigned. A full system of carrying out the auricular method to be used by the staff at General Hospital No. 11 was prepared.

In our work we intended to adopt individual method of training, and if necessary multiplication of this through phonographic attachment. The staff at this hospital, unfortunately, have found this employment indicated only in one or two cases. The crest of our work reached its maximum during the first week of November. Since then there has been a gradual decline of the number of patients received, while the dischargal has been greater than the increase in patients during November and December. We have, therefore, at the present time nearly the same number of patients with which we started the work in July. Throughout our whole work in connection with this section, which has been from the beginning, we have attempted time and again to obtain statistics

as to the probable number of the near deaf and deaf, to the total number of casualties in the various Allied armies, so as if possible to make preparation in advance for the patients we expected to receive. These efforts have been almost always without achieving results. The nearest we have reached have been the statistics furnished by Major Dundas Grant. The British Pension Bureau, through Dundas Grant, furnished the following facts:

"The Director General's Office states that out of the total number pensioned for disability from the beginning of the war to May 31st, 1916, 2.9 per cent were on account of deafness, while from the beginning of the war to May 31, 1918, the percentage was 1.98. A further report states that from the outbreak of the war to August 31, 1918, the total number pensioned for disability is 421,877; of these, 7,731 are invalided on account of deafness, a percentage of 1.83."

These figures would indicate that we under the same conditions should have the same ratio of deaf in connection with the total disabilities. We have expected less, and for two reasons: First, our men as registrants were more carefully examined, and those with defects in the auditory organs were refused as registrants. Some few of those who were accepted and taken into the service, on reexamination were excluded from overseas duty and retained for domestic service. In the second examination of recruits all cases of suppurative ears, discharging or dry, were excluded, as well as those showing any catarrhal affection in the middle ear. Those with any degree of impairment of hearing were accepted only for limited service. Secondly, a large number of the defects in hearing which occurred in the service of the Allies in this war were no doubt due to trench warfare. Trench warfare practically closed with the entrance of the American Army into the conflict, and therefore a large percentage of ear afflictions which were due to trench warfare were eliminated from the service.

These two factors we thoroughly took into consideration in our preparation, and therefore we are not disappointed, and hope that our opinion will be borne out by results.

Results: In the French service it was expected that the average soldier would require about three months of a course

in speech reading. In the British Army it was expected that the same results would be obtained in four months. We had not expected, nor did we intend to make any effort to excel either the French or the British in this type of work. Our effort was simply to give our men the best treatment possible.

Our method has been an intensive one, giving the patient a couple of periods a day up to three, if such could be maintained without causing mental fatigue. We have expected also to find that some patients would not be able to grasp the method and continue the course. In this we have been disappointed. All of our men have shown energy in the work, keenness in desire, which has given a result which is far beyond our expectations. Not only have all the patients been able to read but before they have been discharged they have been able to read speech well, not only with one person but with all people with whom they come in contact.

A couple of patients became interested in the touch method of studying, such as is resorted to by the blind in speech reading. Through the study of this method they have become proficient in reading through touch. When it was requested why they wished to use this method, they stated that they possibly might want to talk to people in the dark, and this would enable them to read what others stated.

The number of patients discharged from the hospital is thirty-two, all of whom are good readers and are able to take care of themselves. These individuals have no difficulty other than that which is common to most proficient speech readers. Ordinarily it is not necessary for them to request a repetition of what is stated. In order to insure that none of these patients might lapse or deteriorate in their ability to read but rather to be improved or be more perfect readers than they are at present, it was decided that all the patients discharged from United States Army General Hospital No. 11 should have the privilege of carrying on practice work at schools or with individual teachers in their home town or near their home town. Arrangement was thus made with a number of schools and aides throughout the country to give the benefit of their work and effort to our discharged patients. A similar arrangement has been made with the Federal Board for Vocational Education. The same schools and aides that are to be em-

ployed by us have been given to the Federal Board for Vocational Education, and they are to furnish practice and instruction to our patients after they have been discharged from the United States Army.

As each patient is discharged from United States Army General Hospital No. 11, he is given a duplicate copy of the name of the teacher or school to which he must apply. He is also given a note or card of introduction to the school or the teacher. Their names and home addresses are also given to the Federal Board for Vocational Education, and they prepare to follow up these men and see that they continue the work and maintain the efficiency which they were giving when they were discharged from United States Army General Hospital No. 11. Besides these results, which are interesting, we have others which might be called secondary in their work. When the sectional work was first established we found that we had enough work to keep our aides in corrective speech work employed.

We found that there were illiterates coming into our hands, whose pronunciation of English was bad and whose vocabulary was limited. Through the efforts of our aides, all the illiterates coming into our department have had their illiteracy corrected. The rapidity with which this is accomplished is truly astounding. The average man in a week or ten days is able to write, to read simple stories, and do simple problems in arithmetic. In three or four weeks they read well any subject that may be presented to them. They write well and they are capable of doing any simple problem in arithmetic. When we take into consideration the number of illiterates that gain assignment in the United States Army, it is a pity that such aides as we have had have not been assigned to various camps in order to correct this large amount of illiteracy. When we consider that the average adult illiterate could have been taught to read and do arithmetic problems of simple character in three weeks, it would have been effort and time well expended. The corrective speech work in connection with speech reading has functionated in correcting bad pronunciation.

We found in the foreign born, while we were teaching them speech reading, we could at the same time correct their bad pronunciation. The increase of their vocabulary was another

result of this effort. Patients who one could understand only with difficulty, and who had a very limited vocabulary, within a couple of weeks could speak as correct English nearly as their teachers and with a wonderfully enlarged vocabulary.

On December 31, 1918, we find that the enrollment of candidates for head aides in the speech reading section amounts to one hundred. All of these teachers signified their willingness to accept service on notice and under full army regulation.

In the speech corrective section, as to the same date, we find fifty-one candidates enrolled to accept service as head aides, under full army regulations. We also had fifty-four candidates for speech reading who were willing to give partial time service. These facts are mentioned to demonstrate how well the country was canvassed for teachers of speech reading and corrective speech work.

Results.—It is impossible to give more than a summary of the results we have attained, both in the speech reading and the corrective speech work. We have discharged sixty-three patients from United States General Hospital No. 11 in the speech reading work. Of this number over fifty completed the course. The course was completed on an average in two months. We feel that the fifty who completed the course were as perfect speech readers as is ordinarily graduated from the best speech reading schools in this country. Our opinion, and that of our expert teachers, possibly prejudiced, is that they are far better perfected than the best students completing the course in the best civilian schools. I will quote from Captain Gordon Berry, who has been in charge of this work for the past two months, as to why he considers our work is better and the reasons therefor:

1. The grade of teachers, each of whom is an expert.

2. The altruistic spirit makes them more efficient in classroom work. They show an optimism as regards the patient that is infectious, cheering the discouraged and stimulating the good worker to better endeavor.

3. The individual instruction which each patient receives.

4. The fact that the deafness is recently acquired.

5. The optimism created by working with others who can demonstrate their progress.

6. The orderly arrangement of the day, the perfect system adopted. The military regime under which the patient lives and has his being conduces to easy discipline.

All of these reasons demonstrate that the theoretical plans upon which the system was instituted has practically evidenced its thorough utility.

Many military medical officers, as well as officers not in the medical corps, have made inspection of our work and have been markedly impressed and extremely enthusiastic over the work being accomplished, its rapidity of attainment and the results gained. Many of these officers were well prepared to judge of the character of the work in hand.

Many teachers of the deaf, noted principals of schools for the promotion of speech reading, and heads of deaf and dumb institutions, made visits to United States General Hospital No. 11 and reviewed and inspected the work in progress. These people are the best judges of the character of work we are attempting to carry out, and their opinion of it carries scientific value, so it is well worth noting.

We naturally were somewhat anxious as to their criticism and judgment of our efforts.

It will, no doubt, please you to know that they were unanimous in their approbation of our methods, delighted with the results which were were gaining, pleased with the possibilities, and congratulatory with the splendid work accomplished.

The most distinguished of these visitors were Dr. Crouter of Mt. Airy School, Philadelphia; Miss Yale and Miss Gaworth of the Clarke School, Northampton, Mass.; Dr. Hall of the Gallaudet College, Washington, D. C.; Mrs. Marsh and Mrs. Berry of the Ohio School for the Deaf; Mr. Pope of the New Jersey Institute, and Mr. Steed of the Mt. Airy School, Philadelphia.

All of these visitors acknowledged that they had been more than repaid for the time and effort made in visiting Cape May: a compliment in itself. Dr. Hall gave a lecture to his faculty on the work at Cape May, on his return from his visit, and although not present, I was told by one of the faculty that it was exceedingly complimentary as to our methods, system, teaching force and results.

The corrective speech work has been as excellent in its re-

sults as the speech reading. Indeed, all of the work in connection with speech correction has been a revelation to those who have not previously known of its possibilities. It stands out as one of the most remarkable results attained by the Medical Corps in the history of the war.

I will close my paper by adding the summary of all cases treated by us as to May 31, 1919, followed by a graphic chart of the medical history of each patient:

Number of patients under treatment:

Section of Defects of Hearing	31 patients
Section of Defects of Speech	25 patients
Total	56 patients

Patients having completed or partially completed courses:

Section of Defects of Hearing	63 patients
Section of Defects of Speech	12 patients
Total	75 patients

Patients enrolled since July 23, 1918:

Section of Defects of Hearing	99 patients
Section of Defects of Speech	37 patients
Total	136 patients

Deaf patients improving under treatment so as to render continuing courses unnecessary, ten patients, or 16⅔% of the number discharged from section.

Number totally deaf, 28 patients—29%.

Number having had trouble previous to entering the service, 46 patients—47%.

Countries represented in birthplaces, 10—France, Russia, Poland, Italy, Norway, Ireland, Greece, Spain, America, Germany.

Average time for lip reading course, two months.

Daily schedule, 1½ hours per man, ¾ to ½ hour periods.

Number of instructors: Section of Defects of Hearing, from July 23 to August 21, 4; August 21 to September 3, 6; September 3 to October 22, 7; October 22 to February 1, 8;

February 1 to May 1, 7; May 1 to May 15, 8. Section of Defects of Speech, from July 23 to August 21, 1; August 21 to May 15, 3.

Classification of Cases.—Section of Defects of Speech:

Aphasics	14	patients
Imperfect phonation cases	13	patients
Stammerers	3	patients
Aphasic and stutterer	1	patient
Multiple neuritis	1	patient
Aphonia cases	2	patients
Stutterers	2	patients
Stammerers and stutterers	1	patient
Total	37	patients

Section of Defects of Hearing:

Cases which have completed treatment	63	
In line of duty	43	
Not in line of duty	20	
Having otitis interna, result of gunfire		2
Shell explosions		8
Basal fracture		2
Meningitis		4
Other causes		9
Extension from middle ear		14
Deafness from catarrhal ears		9
Deafness from suppurative ears		22
Of the 22 suppurative ears there were discharged dry		19
Cases hearing much improved		14
Otosclerosis		1
The labyrinth tests were not routinely done in all. Of six tests noted, there were sluggish reactions in		3
No reactions, or dead labyrinths, in		3
Cases still under treatment (in line of duty, 36; not in line of duty, 3)		39
Having otitis interna, result of gunfire		4
Shell explosion		6
Basal fracture		2
Meningitis		14

Other causes, other than middle ear	0
Extension from middle ear	6
Deafness caused by catarrhal deafness	2
Suppurative otitis	4
Four running cases, still here, now dry	3
Hearing much improved in	2
With otosclerosis	1

Almost all the labyrinths in this group were tested, and the balance will be.

Hyperactive labyrinths	2
Sluggish labyrinths	6
Dead labyrinths	12

These labyrinthine tests were done in the otitis interna cases. The "dead" labyrinths were in the otitis interna following meningitis cases.

"SHELL SHOCK CASES."

There were two cases of otitis interna from shell explosion. The otitis interna had cleared or nearly cleared when they arrived here. The deafness continued from hysteria. Under suggestion, and with rest, the hysterical condition cleared and the hearing became normal in each case. In one case only one ear returned to normal because the other ear had been deaf for years, a chronic condition. These two were cases which earlier would have been considered shell shock cases.

Two cases died from meningitis, consequent on a chronic brain abscess, secondary to a chronic otitis media suppurativa.

SUMMARY OF PATIENTS.

NAME Admitted Discharged	CAUSE OF DEAFNESS Primary	Secondary	LOD	DEGREE OF DEAFNESS On admission	On discharge	PATHOLOGY On admission	On discharge
1. Aasen, J. M. 7/ 9/18 12/16/18	O. I. B. from meningitis	None	Yes	R. whisper O. L. whisper O.	R. voice O. L. voice O.	None on record	None on record Labs. dead
2. Anderson, C. L.	O. I. B. fr. basal fracture, struck on head by billet of wood while intoxicated		No	R.-O. L. loud shout		Middle ears normal. Refused lip reading	Same Labs. dead
3. Anderson, L. H. 6/ 4/18 11/10/18	O. I. B. fr. sunstroke	None	Yes	R. whisper O. L. whisper O.	No change	None	None
4. Baas, Leland 12/22/18 3/ 6/19	O. M. C. C. right O. M. S. C. left, aggravated by gunfire	Measles	No	R. whisper 6 in. L. whisper 3 in.	R. whisper 4 ft. L. whisper 2 ft.	Extreme retraction M. T. L., scar from perforation M. T.	No change No change
5. Baldwin, A. G. 7/ 1/18 12/19/19	O. M. S. C. B. Follicular tonsillitis	Same	Yes	R. whisper 2 in. L. whisper 1 ft.	R. whisper 3 ft. L. whisper 4 ft.	R. Sup. Chr. L. Sup. Chr.	R. dry L. no change
6. Barnum, Miles 9/21/18 12/16/18	O. I. B. from shrapnel explosion	O. I. from fractured skull	Yes	R.-O. L.-O.	R. shout 6 in. L.—O.	Both drums retracted	No change
7. Bates, Ivan L. W. 8/22/18 1/ 4/19	O. M. S. C. Left O. M. S. C. Right	Same Same	Yes Yes	R. 4 ft. L. 6 in.	R. 16 ft. L. 6 ft.	Sup. left ear. Right drum retracted	No change
8. Buster, William 8/27/18 12/16/18	O. M. C. C. Right O. M. S. C. Left	Same	No	R. 3 in. L. 3 in.	R. shout 1 ft. L. shout 1 ft.	Rt. M. T. retracted Lt. M. T. perforated Suppurating	No change Lt. ear dry
9. Christensen, Christ 10/19/18 1/ 8/19	O. M. S. A. Right O. M. C. C. Left	Same Same	Yes	R. Loud voice 1 ft. L. Loud voice 6 in. 8/28/18	R. 1 ft. 11/5/18 L. 6 in.	Both drums retracted intract Right drum retracted	No change Same
10. Birkman, Lt.F.W. 11/22/18 4/10/19	O. M. C. C. Right Mastoiditis, rad. mastoid, mumps, deafness left	Same	Yes	R. 2 ft. L. Loud 2 in.	R. 1 ft. L. 1 ft.	Left drum absent	
11. Collins, Harry 10/ 9/18 1/ 6/19	O. I. B. fr. shell explosion	O. M. S. C. B.	No	R. O. L. 1 in.	R. 8 ft. L. 20 ft.	Both ears discharging	No change Left ear dry
12. Ditcher, William 10/19/18 1/ 4/19	O. M. S. C. B.	Pertussis	No	R. 3 ft. L.-shout	R. 20 ft. L. 6 ft.	Both ears discharging profusely	Both ears discharging slight
13. Dorn, Arthur 1/ 4/19 1/30/19	O. M. C. C. B. aggra. in France	Same	No	R. 3 ft. L. 3 ft. 5 in.	R. 18 ft. L. 12 ft.	Slight retraction, both drums	No change
14. Douglas, Allan E. 7/ 2/18 10/14/18	O. M. S. C. B.	Same	No	R. 3 in. L. 2 in.	R. 6 in. L. 5 in.	Negative	Both ears dry

SUMMARY OF PATIENTS—Continued.

NAME Admitted Discharged	CAUSE OF DEAFNESS Primary	 Secondary	LOD	DEGREE OF DEAFNESS On admission	 On discharge	PATHOLOGY On admission	 On discharge
15. Edwards, Geo. E. 11/19/18 1/ 4/19	O. I. R. from O. M. C. C. B.	O. I. L. from injury of head by fall in childhood	Yes	Both ears—O.	Both ears—O.	Retraction of both drums	No change. Labs., R. dead; L. normal
16. Ford, Clyde A. 6/17/18 8/14/18	O. M. S. C. B.	Same	Yes	Both ears—O.	Both ears—O.	Both ears discharging	Discharge from ears not so profuse
17. Gaulke, Lt. Walter 12/22/18 5/14/19	O. I. B. from shell explosion	Same	Yes	R. 20 ft. L. 14 ft.	R. 20 ft. L. 20 ft.	Both drums intact	Still in hospital
18. Halstead, Wm. J. 9/17/18 11/23/18	O. M. S. C. B., aggravated in France	Same	Yes for O.	R.—O. L.—O.	R.—O. L.—O.	Both ears discharging	Labs. hypersen've Both ears dry
19. Hanlon, Richard 6/ 7/18 11/22/18	O. M. C. C. B., aggravated in service	Blow on head 1 yr. previous to M. S.	No	R.-O. L. 15 ft.	R.-O. L. 2 ft.	Nothing	No change
20. Heitz, Walter 12/12/18 2/ 4/19	G. S. W. head. O. I. B.	Same	No	R. 3 ft. L. 9 ft.	R. 1 ft. L.-loud v. 4 in.	Negative	Negative
21. Henyon, Paul J. 5/27/18 11/20/18	O. M. C. B.	Same	Yes	R.-O. L.-O.	Shout both ears	Negative	Negative
22. Howard, S. M. 9/19/18 11/27/18	O. M. S. C. B.	Same	No	R. 1 ft. L. 5 ft.	R. 2 ft. L. 4 ft.	Both ears discharging	Both ears dry
23. Jaussand, Emilin 10/24/18 12/16/18	O. M. S. C. Bil		No	R. whisper 5 ft. L. whisper 2.5 ft.	R.-voice 4 ft. L.-voice 1 ft.	Rt. drum perf. gran. in up. 3-4. Left drum perf. grans.	Right ear discharging and grans. Left ear dry
24. Jones, P. W. 7/ 1/18 11/25/18	O. M. S. C. B.	Same	Yes	R. 10 ft. L. 3 ft.	R. 18 ft. L. 6 ft.	Both ears discharging	Rt. discharging. Left ear dry
25. Kettelhohn, H. E. 7/ 1/18 11/24/18	O. M. C. C. right O. M. S. C. left	Same	Yes	R. 18 ft. L. 18 ft.	R. shout L. shout	Marked retraction Rt. drum. Left drum healed	No change
26. Kaelin, Fred 8/27/18 10/ 5/18	O. M. S. C. Bil.	Meningitis	No	R. 1 in. L.-shout	R. 2 ft. L. 1 ft.	Perf. in both drums and suppurating	Died
27. Keppler, Thurman 11/19/18 1/ 8/19	O. I. B. fol. scarlet fever 11 yrs. past	Scarlet fever	No	R. 6 in. L. 4 in.	R. 5 ft. L. 4 ft.	Marked retraction both M. T.	No change
28. Lepley, Isadore 7/19/18 12/20/19	O. I. (meningitis), bilateral		No	R. 1 ft. L. 1.5 ft.	R. 2 ft. L. 8 ft.	Drums normal	Same
29. Lewis, Matthew 12/22/18 3/30/19	O. I. (mumps), bilateral		R. No L. Yes	R. 3 in. L. 1 in.	R. 8 in. L. 6 in.	Drums normal	Same. Labs. sluggish
30. Luloff, Morris 1/ 4/19 1/30/19	O. M. C. C. B.		Yes	R. 1 ft. L. 1 in.	Died	Retracted dull drums	Same
31. Mahon, Edward 10/ 2/18 12/20/18	O. I. exten. fr. mid. ear, bilateral	O. M. S. 16 yrs. fol. smallpox	No	R. 1.5 in. L. 1 ft.	R. 3 ft. L. 3 ft.	R. foul disch., perf. L. foul disch., perf., with grans.	Both ears dry

SUMMARY OF PATIENTS—Continued.

NAME Admitted Discharged	CAUSE OF DEAFNESS Primary	 Secondary	LOD	DEGREE OF DEAFNESS On admission	 On discharge	PATHOLOGY On admission	 On discharge
32. Mattos, John 8/ 1/18 12/20/18	O. I. (shell con.), bilateral	O. I. B. fr. basal frac. 1916: cured O. M. S. B.	Yes for O. I.	R.—O. L.—O.	R.—O. L.—O.	R. small perf. behind handle of malleus dry L. mod. disch., polyp hanging fr. Shrapnel's membrane	Dry M. T.
33. May, Joseph 7/19/18 9/25/18	O. M. S. C. R. since childhood O. M. C. C. left		Yes No	R. 2 ft. L. 20 ft.	R. 4 in. L. 1.5 in.	R. mastoid healed, foul disch. L., M. T. dull and retracted	R.—M. T. dry
34. McGinn, Joseph 12/ 2/18 1/18/19	O. I. B.	O. M. S. C. left O. M. S. C. right, residual	Yes	R.—O. L.—O.	R.—O. L.—O.	Perf. healed right. L. perf., polyp, disch.	Dry
35. McCurley, Alf D. 11/ 6 /18	O. I. fr. shell explosion	Same	Yes	R.—O. L.—6 in.	R.—O. L.—20 ft.	Both drums slightly retracted	Same
36. Mitchell, Jefferson 1/28/19 5/ 3/19	O. I.—Loss of left eye (shell explo.)	Same	Yes	R.—4 ft. L.—O.	R.—5 ft. L.—O.	Both drums slightly retracted, intact	Same
37. Modesky, S. A. 10/ 2/18 12/28/18	O. I. B., grad onset	O. M. S. C., resid. Bil.	Yes	R. 1 in. L. 2 in.	R. 6 in. L. 1 in.	Healed adherent retracted scars in both drums	Same
38. Morris, Charley 10/ 2/18 12/28/18	O. I. B. (mumps)	O. M. C. C. R.	Yes	R.—O. L.—loud shout	R.—O. L.—O.	Drums thickened and retracted	Same
39. Moss, George E. 6/22/18 11/16/18	O. I. B. (meningitis)	O. I. Lt. fr. childhood, scalded fr. hot tea	R. Yes L. No	R.—shout L.—O.	R.—shout L.—O.	Drums thickened and retracted	Same
40. Murphree, Frank 7/1/18 11/29/18	O. M. C. C. Bil.	O. M. S. C. B., healed	No	R. 4 in. L. 2 in.	R.—shout L.—loud voice	Drums intact, retracted	Same
41. Myers, Ernest 12/ 7/18 1/23/19	O. M. C. C. B.	Same	Yes	R. 2 ft. L. 3 ft.	R. 4 ft. L. 4 ft.	Both drums thickened and retracted	Same
42. O'Brien, Lt. H. N. 9/14/18 11/ 1/18	O. I. (gunfire)	O. M. C. C. B.	Yes	R.—O. L. 4 ft.	R.—O. L.—3 ft.	Both drums intact. Slight retraction	Same. Inflation failed to help
43. Palarzi, Frank 11/ 1/18 12/16/18	O. I. B.	O. M. S. C. B.	Yes for O. I. B.	R.—shout L.—O.	R.—O. L.—O.	Both ears discharging	Ears dry, perforated
44. Pistelli, Emilio 11/29-18 3/15/19	O. I. Bil.	Meningitis	Yes	R.—O. L.—O.		Drums normal	Dead lab.
45. Porter, Buel F. 9/19/18 11/30/18	O. I. B.	From O. M. S. C. B.	No	R.—shout L.—shout	R. shout L. shout	R. dry, perforation L. disch. and grans.	Ears dry, perforated
46. Recoy, Charles 7/ 1/18 11/26/18	O. I. B., onset gradual, cause not determined	O. M. C. C. B.	Yes	R.—4 ft. L.—O.	R.—shout L.—O.	Drums thickened and retracted	Same

SUMMARY OF PATIENTS—Continued.

NAME	CAUSE OF DEAFNESS		LOD	DEGREE OF DEAFNESS		PATHOLOGY	
Admitted Discharged	Primary	Secondary		On admission	On discharge	On admission	On discharge
47. Rock, William 3/ 5/19 In hosp.	O. I. right (yes) O. In. left, specific	Syphilis Sec.	No	R.—O. L.—20 ft.	R.—O. L.—4 ft.	Both drums retracted, intact	
48. Ross, Geo. D. 5/29/18 11/29/18	O. I. B. with labyrinthitis from scarlet fever in 1918 causing O. M. S. C. B.	O. M. S. C. B. with mastoiditis L.	Yes	R. 3 ft. L. 3 ft.	R.—shout L.—shout	R. chr. disch. L. chr. disch. with mastoiditis	R. chr. Tube disch. slight. L. same. Rad. mast. oper. done
49. Ruhland 11/10/18 1/25/19	O. I. B., cause unknown	O. M. C. C. B.	Yes for O. I. B.	R.—O. L.—loud voice	R.—O. L.—loud voice	R. discharging L. drum thickened	R. ear nearly dry L. drum intact
50. Schimmell, Jos. 8/.1/18 11/21/18	O. M. S. C. right O. M. C. C. left		No No No	R. 2 in. L. 1 in.	R. 6 in. L. 4 in.	R. drum perf., disch.	Same
51. Sears, Frank 7/19/18 11/23/18	O. I. left O. I. B. (gunfire)	O. M. S. C. B.	Yes	R.—O. L.—shout	R.—O. L.—shout	L. drum retracted Both ears discharging	Ears dry, drums perforated
52. Shaw, Shadrack 9/ 7/18 12/16/18	O. I. B., cause unknown	R. 20 yrs, L. 3 mos., same	Yes	R.—O. L.—O.	R.—O. L.—O.	Drums intact, thin and retracted	Same
53. Shmerfeld, Fred 12/12/18 3/ 6/19	O. I. B. partial, cause unknown	O. M. S. C. right	No	R. 2 ft. L. 1 ft.	R. 5 ft. L. 6 in.	Both drums intact, dull and retracted	Same
54. Sindler, Thos. P. 11/ 1/18 12/19/18	Otosclerosis B.	Same	No	R.—shout L.—5 in.	R.—O. L.—1 ft.	Both drums slightly retracted	Same
55. Solomon, Frank 11/10/18 5/ 3/19	O. I. B., cause unknown	Same	Yes	R.—O. L.—O.	R.—O. L.—O.	Both drums normal	Labs. dead Same
56. Straubert, Geo. 6/1/18 10/30/18	O. I. B., cause unknown	O. M. C. C. B.	Yes	R.—1 ft. L.—O.	R.—2 ft. L.—O.	Both drums dull and retracted	Same
57. Toler, Major 5/26/18 1/16/19	O. I. B. fr. salvarsan	O. M. C. C. B. (syphilis, tertiary)	Yes	R.—O. L.—O.	R.—O. L.—O.	Both drums normal	Same
58. Warshoefsky, I. 10/23/18 11/23/18	O. I. cause unknown	O. M. C. C. B	R. No L. Yes	R.—1 in. L.—O.	R.—1 in. L.—O.	Both drums intact, slightly retracted	Same
59. Williams, Orlando 11/25/18 2/13/19	O. M. C. C. B.	Atrophic rhinitis	No	R. —10 ft. L.—2 ft.	R.—16 ft. L.—4 ft.	Both drums dull and retracted	Same. Lip reading course not comp., acct. good hear'g
60. Wilson, Henry M. 5/31/18 11/21/18	O. I. from shell exp.		Yes	R.—O. L.—2 in.	R.—O. L.—1 ft.	Both drums retracted and dull	Same
61. Womack, Jesse 2/22/19 4/19/19	O. I. B. (onset grad.)	O. M. S. C. B.	Yes	R.—2 in. L.—shout	R.—shout L.—O.	Both ears show dry perforations	Same
62. Woods, Robert 12/31/18 1/16/19	O. I. B. from shell explosion	Prolonged by hysteria	Yes	R.—2 in. L.—shout	R.—20 ft. L.—14 ft.	Both drums slightly retracted	Same. Course not completed acct. good hearing
63. York, Linwood 11/ 9/18 12/20/18	O. I. with labyrin. bilateral	O. M. S. C. B.	Yes	R.—8 in. L.—2 in.	R.—16 ft. L.—12 ft.	Both drums retracted, intact	Same

SUMMARY OF PATIENTS—Continued.

NAME Admitted Discharged	CAUSE OF DEAFNESS Primary	Secondary	LOD	DEGREE OF DEAFNESS On admission	On discharge	PATHOLOGY On admission
1. Babiak, Brune 3/13/19 In hosp.	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Both M. T. dull Both lab. dead
2. Boyer, Louis 5/ 6/19 In hosp.	O. M. C. C. B.	Influenza	Yes	R.—1 ft. L.—5 in.	No change on 5/14/19	Both drums retracted
3. Burt, Lt. C. C. 4/ 4/19 In hosp.	O. M. C. C. right O. I. left	Concussion, shells, France	Yes	R.—10 ft. L.—O.	No change on 5/14/19	Both drums slightly retracted Both labs. hypersensitive Both drums normal
4. Caller, William 10/24/18 In hosp.	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Both drums normal Both labs. dead
5. Duntic, Samuel 11/19/18 In hosp.	O. I. B. gassed O. M. S. C. right	O. M. S. C. R. when a child	Yes	R.—O. L.—O.	No change on 5/14/19	Right drum thickened Left drum healed scars Both labs. sluggish
6. Donahue, Patrick 1/21/19 In hosp.	O. I. B. fr. gunfire	Meningitis	Yes	R.—loud 1 ft. L.—loud 4 ft.	No change on 5/14/19	Both drums slightly retracted Right lab. dead
7. Furman, Moe 2/ 8/19 In hosp.	O. M. S. C. right O. M. S. C. left		R. No L. Yes	R.—1 ft. L.—2 ft.	R. 4 ft., L. 4 ft. on 4/19/19	Profuse discharge, both ears
8. Goodwin, Jas. E. 3/29/19 In hosp.	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Drums slightly retracted Both labs. dead
9. Hagland, Oscar P. 2/11/19 In hosp.	O. I. B. fr. concussion while working in boiler shop in France	Syphilis	Yes	R.—1 ft. L.—1 ft.	No change on 5/14/19	Both drums thickened and retracted. Both labs. sluggish
10. Hanaway, Thomas 12/22/18 In hosp.	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Both drums normal Both labyrinths dead
11. Harding, Wildy G. 3/ 7/19	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Both drums slightly retracted Both labs. dead
12. Hughes, Anna Not admitted Nurse on duty	O. M. C. C. B.		No	R.—4 ft. L.—4 ft.	No change on 5/14/19	Drums retracted
13. Kirby, Alby 4/11/19 In hosp.	1. O. M. S. C. R. right 2. O. M. S. C. R. left 3. O. I. B.		1 & 3 Yes 2, No	R.—1 ft. L.—1 in.	R. 4 ft., L. 1 ft. on 5/14/19	Right drum shows a depressed scar. Left drum shows a perforation. Both labs sluggish
14. Lafferty, Claude 3/ 3/19 In hosp.	O. I. B. fr. meningitis		Yes	R.—O. L.—O.	No change on 5/14/19	Both drums intact but slightly thickened and retracted
15. Lockwood, W. S. 3/ 5/19 In hosp.	O. I. fr. meningitis	None	Yes	R.—O. L.—O.		Drums normal, lab. dead
16. Lucas, Capt. Elmer 10/ 2/18 In hosp.	O. I. (shell concussion)	O. M. C. C. left Syphilis, tertiary	Yes	R.—2 ft. L.—O.		Drums retracted—more on left
17. McCurdy, R. H. 12/17/18 In hosp.	O. I. B. fr. meningitis	None	Yes	R.—O. L.—O.		Labs dead. Drums intact—

SUMMARY OF PATIENTS—Continued.

NAME Admitted Discharged	CAUSE OF DEAFNESS Primary	 Secondary	DEGREE OF DEAFNESS LOD	 On admission	PATHOLOGY On admission
18. Miller, Lonnie 4/ 3/19 In hosp.	O. M. C. C. right O. M. S. C. left	Same	R. Yes L. No	R.—4 ft. L.—6 in.	Right drum intact, thickened Left ear discharging
19. Milum, Lt. V. G. 9/25/18 In hosp.	O. I. right, with labyrinthitis, G. S. W.		Yes	R.—10 in. L.—20 ft.	Right M. T. dull and retracted. Same. Lab. sluggish.
20. Minninger, J. E. 4/18/19 In hosp.	O. I. B. from gunfire	None	Yes	R.—1 ft. L.—2 ft.	Drums slightly retracted. Labs. hypersensitive.
21. Murdock, A. L. 4/ 2/19 In hosp.	O. I. B. from meningitis	None	Yes	R.—O. L.—O.	Drums normal. Labs. dead.
22. Parker, Abram 3/29/19 In hosp.	O. M. C. C. B.	Same	Yes	R.—3 in. L.—1 ft.	Both drums retracted.
23. Partridge, M. F. 3/29/19 In hosp.	Otosclerosis, bilateral	None	No	R.—3 ft. L.—3 ft.	Drums slightly retracted.
24. Price, Samuel 2/25/19 In hosp.	O. I. from meningitis	None	Yes	R.—O. L.—O.	Drums normal. Both labs. dead.
25. Riddell, Clarence 5/ 6/19 In hosp.	O. I. (shell concussion)	None	Yes	R.—O. L.—O.	Perforation both M. T. Labs. sluggish
26. Robinson, T. E. 2/20/19 In hosp.	O. I. from meningitis	None	Yes	R.—O. L.—O.	Drums normal. Both labs. dead.
27. Scott, Roy 3/ 7/19 In hosp.	O. I. right O. M. S. C. B.	O. M. C. C. B.	Yes	R.—1 in. L.—20 ft.	Right ear discharging. Left ear dry, small perf. Both labs. sluggish.
28. Silsbee, Lt. J. E. 4/27/19 In hosp.	O. I. B.	O. M. C. C. B.	No 3. No	R.—O. L.—8 in.	
29. Shubert, Andrew 12/22/18 In hosp.	1. G. S. W. parietal reg. 2. O. det. partial	3. O. M. C. C. B.	1 & 2. Yes	R.—5 in. L.—1 in.	M. T. retracted.
30. Smith, Lt.C.W. H. 5/ 3/19 In hosp.	O. I. B. (shell concus.)	O. M. S. C. B.	Yes	R.—7 in. L.—9 in.	Lower half drums destroyed. Mucopus.
31. Ulanofsky, Morris 4/29/19 In hosp.	O. I. B. (shell concus.)	O. M. C. C. B.	Yes	R.—4 ft. L.—1 ft.	M. T. retracted
32. Walters, Jos. F. 1/24/19 In hosp.	O. I. B. (shell concus.)	None	Yes	R.—O. L.—4 ft.	Labs. normal. Right M. T. dull, retracted, scarred. Left M. T. retract.
33. Watson, Luther 3/13/19 In hosp.	O. I. with labyrinthitis-meningitis	None	Yes	R.—O. L.—O.	M. T. retracted. Lab. dead.
34. Westbury, J. C. 4/17/19 In hosp.	O. I. B. with labyrinthitis-meningitis	O. M. S. C. right	No Yes	R.—O. L.—O.	Right M. T. perforated, chronic, disch. Labyrinths dead.
35. Whittaker, Thomas 3/20/19 In hosp.	O. I. B. labyrinthitis-meningitis	None	LOD No	R.—O. L.—O.	M. T. retracted. Labs. dead.
36. Yancy, William 2/11/19 In hosp.	O. I. B. (Yes)	O. M. C. C. B.		R.—1 ft. L.—1 ft.	Negative. Labyrinths sluggish.

XXI.

NASAL SINUS DISEASE IN INFANTS AND YOUNG CHILDREN, INCLUDING BACTERIOLOGIC STUDY.*

By L. W. Dean, M. D., and Margaret Armstrong, M. D.,

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All of the pathologic and bacteriologic work mentioned herein was done by Doctor Armstrong, pathologist for the head specialties in the University Hospital.

The importance of the work in sinusitis in infants and young children is always made plain to us by reviewing some of our cases. We think of the first case that was responsible for our work in this subject. It was a boy eight years of age who had multiple arthritis; he was confined to bed; he could not feed himself. In January, 1917, I removed his tonsils and adenoids and examined the nasal sinuses, and reported no pathologic condition present. Two months later he was no better. A second examination of the sinuses was made, and a negative report sent to the orthopedic surgeon. Four months after this, the boy was again seen, and he was still no better. The orthopedic surgeon told me if we did not find the focus of infection that every joint in his body, including the temporomandibular would soon be ankylosed. With such a serious problem before us, a third complete examination was made. It showed involvement of the ethmoids right, and the ethmoids and sphenoids left. This condition was eradicated. This resulted in the disappearance of all acute joint trouble. Not only did he not have any acute trouble in his joints but the condition was so quiescent that the usual orthopedic treatment for ankylosis was instituted with very satisfactory results. Recently the

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boy attempted football on his crutches. There was evidently a family organism, as his brother, who did not come under our care, died of multiple arthritis with ankylosis of every joint including those of the spinal column and jaw.

There was another case, eighteen months old, with a posterior cleft operated twice by good surgeons, with infection and bad results, where postoperative healing took place perfectly after the eradication of the sinus infection.

Then a case of seven years of age that had had since one year of age a tendency to develop a temperature of 101, with evidence of respiratory infection without apparent cause—more noticeable when he has a cold, but is present when he does not have one. The removal of the tonsils and adenoids diminished the number of attacks only; six months after their removal he had an irregular temperature, ranging from normal to 102 degrees without the patient giving any sign of having fever. A chronic bilateral nasal sinus infection was treated eighteen months ago, with a complete disappearance of his trouble.

Then there was the case of noma sixteen months old that died, and the postmortem revealed an unsuspected necrosis of the ethmoids; of a patient four and one-half years old relieved of cyclic vomiting by treatment of a left Highmorian empyema; of a baby twenty months old relieved of a miserable nasal discharge, by treatment of the nasal sinuses; of a child eleven years old with asthma, and left sphenoidal empyema—one year after the drainage of the sphenoid reporting no asthma.

Then there are cases of nephritis, headache, neuralgia of the fifth nerve, neurotrophic disturbances, especially in infants, chorea, pulmonary infections, laryngitis, improved if not apparently cured by the treatment of nasal sinus disease.

None of these cases have been under our care alone. Most cases were referred by the Department of Pediatrics, or Orthopedic surgery, for study. In every case, a Pediatrician or Orthopedic Surgeon, or both were associated with us in the handling of the case. The best thing that can be said about this work is that these men have been satisfied with the results. In short, I think we may safely say that the orthopedic sur-

geon expects us to find the focus of infection in all of his children suffering from infectious arthritis.

In all cases of infectious arthritis in infants and young children studied by us during the last eighteen months, the source of infection has been in the upper respiratory tract. It has been in the nasal sinuses, or faucial or pharyngeal tonsils.

In no case were the teeth the source of the infection, or the gall bladder, or the appendix. We get the impression from our cases at least that in children, continued search of the throat and nose should be kept up if the infection persists. We never return a case of systemic infection to the pediatrician or orthopedic surgeon without a request for the return of the patient if any acute trouble appears; we get these patients back frequently and find a sinus is not draining properly, or we have overlooked a diseased cell. The results of repeated examination and treatments have been most satisfactory.

We have found that our methods of diagnosis in this class of cases are so unsatisfactory that it is only by exercising the greatest patience, and making one examination after another, and not giving up until the acute trouble in the joint has disappeared, that we secure our good results.

In no case of our series was the lingual tonsil found to be the source of infection. Our adult orthopedic service is not one-tenth as large as that of children, nevertheless in the adults we have found the focus in several cases to be in the lingual tonsil. With our present series of cases, we are not prepared to exclude either lingual tonsil, gall bladder, appendix, etc., as foci in children, but we do feel our results indicate the necessity of continued search in the nose and throat.

Occasionally, elevation of temperature and increased joint disease has been noted following operation on, or treatment of the sinuses. This, we have found to be due to injury of the joint during treatment or operation, and not to any added infection.

All serious cases were examined for syphilis, and where this condition was found they were excluded from our study.

Diagnosis of sinus disease. The most common symptom in our cases of nasal sinusitis, has been sneezing. In infants especially, does sneezing seem to be a very common symptom.

But few of our cases have not had this symptom well developed. There are, however, many other conditions besides sinus disease which cause sneezing in children. Other prominent symptoms are recurrent stoppage of the nose, frequent colds, nasal discharge and headache. The history of postnasal discharge so common in the adult, is conspicuous by its absence. A condition characterized by listlessness, poor appetite, underweight, poor color, so commonly caused by diseased tonsils and adenoids, which persists after the removal of the tonsils and adenoids with a negative report from the pediatrician so far as a systemic condition is concerned, is very suspicious of sinus disease. It is our custom to ask the parents of children who have had tonsils and adenoids removed, to bring the patients back to us if the result of the operation is not satisfactory—in that, the child does not improve as it should. If the pediatrician fails to find any trouble outside of the upper respiratory tract, the cause of the patient being below par is probably in the sinuses, and the removal of the sinus disease will bring about that conspicuous improvement which so commonly follows the tonsil and adenoid operation.

Direct inspection of the nose is very unsatisfactory in infants and young children. The nasopharyngoscope helps very much. We usually make the examination at a time when anesthetic is being used for removal of the tonsils and adenoids. With the child on its back, and the nasopharynx kept clean by suction a fair examination can be made. We have diagnosed a unilateral sphenoidal trouble by this procedure alone in a child of eleven. In infants it is necessary to familiarize ourselves with the normal nose, as the color and comparative thickness of the turbinate is quite different from that of the adult. Transillumination is naturally unsatisfactory.

The X-ray examination is very necessary because it is the only way of telling definitely whether a given sinus is present or not, and if present its size. The variations in the sizes of infants' and children's sinuses are so great as to leave us completely at sea without this picture. We would not puncture an antrum of Highmore without first determining whether or not it was present, and if present, its size, and the location of its floor. With such a plate before us, we believe that the antrum in infants, if of notable size in the plate, may be punc-

tured and irrigated without danger. For operative work a good plate is very essential. For diagnosing the pathologic condition of the sinuses, radiography is very unreliable. In this class of patients, the thickness of bone interferes with X-ray work. The bone surrounding the sinuses being cancellous does not give the clear picture we get in the adult. At any rate, our interpretations of the plates have not been correct in a large percentage of the cases. In two cases clear pictures were secured with pus in a sinus.

Having found what sinuses are present, the diagnosis of sinus disease is still a very difficult one. It is only by repeated examinations of the nose, careful study of the case from every angle that a proper diagnosis can be made. We feel that the bacteriologic investigation of the sinuses is a very important aid. Especially is this true of the Highmorian antrum which, next to the ethmoids, we have found most frequently diseased in the class of cases under consideration. In the diagnosis of obscure sinus disease it has given us the most satisfactory results.

The macroscopic examination of the washings from the sinuses is not reliable. An antrum puncture may be made in the ordinary way, and the fluid coming from the nose may be perfectly clear and still the antrum be filled with thick pus. Or the washings from the antrum may contain numerous macroscopic particles which may be, on one hand, made up of pus cells with virulent organisms; or, on the other hand, pure mucus without pus cells or virulent organisms. Ordinary antrum puncture and the washings of the contents of the sinus into the nose, we do not feel is satisfactory; certainly, for purposes of bacteriologic examination it is for numerous evident reasons a very unsatisfactory procedure. Our method in making the bacteriologic examination of the sinuses will be described later in this article.

The most important thing in the treatment of nasal sinus disease in infants and young children is the removal of the adenoids and diseased tonsils if present. It is necessary to remove the tonsils if they are diseased, as well as the adenoids.

In one of our cleft palate cases, two years of age, hemolytic streptococci were recovered from each antrum. This youngster had a history of having had erysipelas. He had two dis-

charging ears, each being due to a hemolytic streptococcus. A rabbit injected with a culture of streptococcus from the antrum showed marked toxemia in twenty-four hours, from which it recovered, and later an arthritis developed, which persisted for two months. Two months after the injection the animal was killed, and the findings were as follows: Chronic bursitis, fibrosis of the right lung, endocarditis; a hemolytic streptococcus was isolated from the joints and heart. The interesting thing about this case is that for six or eight weeks after the removal of the adenoids, and by using various kinds of treatment, we were unable to eradicate the nasal sinus disease. We did not want to remove the tonsils because of the scar tissue which would form and perhaps interfere with the successful closure of the posterior cleft. After six or eight weeks of treatment it seemed perfectly plain that it was a question of either removing the tonsils or not eradicating the sinus disease. The tonsils were removed. After the removal of the tonsils the same nasal treatment was continued, and several weeks after, the sinuses were found sterile. One ear had become healed; the other ear was very much improved. The clinical symptoms of the sinus disease had disappeared. From the tonsils the same hemolytic streptococcus was recovered. The only possible way to get rid of the sinus disease in this instance was to remove the tonsils.

Up to July 1, 1918, we had examined the sinuses of two hundred and thirty-four children, thirteen years of age or younger, suffering from adenoids. Many of them had also chronic tonsillitis. In 15 per cent of these cases an infection of one or more sinuses was found. These sinus infections were not treated, only the tonsils and adenoids removed, and the patients were asked to return in four or six weeks for examination. Only seven cases returned for examination; five out of the seven were found to be apparently free of sinus disease. The disappearance of the sinus disease was due to the removal of the tonsils and adenoids.

Since July 1, last, we have investigated the sinuses in one hundred and forty-five cases with adenoids, or with adenoids and chronic tonsillitis. Of these one hundred and forty-five, sixty-five had some definite sinus disease, the infection in many instances being exceedingly mild and in some instances very

virulent. The bacteriologic findings in these cases will be discussed later. These patients had their tonsils and adenoids removed and were asked to return in four or six weeks for examination. Six returned, and of these four were found to have no sinus disease.

We feel that the first thing in the treatment of sinus disease is the eradication of adenoids, and of diseased tonsils if present. Sinus disease in children yields particularly well to treatment. The method of Haskins and Coffin we have found to be exceptionally excellent. Especially has the Haskins treatment proven successful in our posterior cleft cases. We do not hesitate with our Highmorian sinus cases to make an opening in the inferior meatus very small, so that it will close in twenty-one days. Through this opening a canula may be introduced for the purpose of this irrigation or for the use of the Coffin treatment.

Naturally, operative work on the turbinates or destruction of the sinuses is to be avoided in infants and young children. Only rarely is it necessary to resort to such procedure. As I view it, that would be indicated only in those very severe cases of arthritis or systemic infections where local treatment and climatic influence seemed to be of no avail. Those children who are suffering from sinus disease and who can be sent to a high and dry climate are certainly very much benefited.

We had one arthritis case in a young child two years ago that in spite of our treatment did not heal until hot dry weather. Then the nasal condition disappeared with the usual marked improvement in the arthritic condition.

Our most interesting work during the past year has been a study of the bacteriology of sinus disease in this class of cases.

Before undertaking to explain our findings in diseased sinuses it seemed wise to familiarize ourselves with the bacterial findings in healthy sinuses. Skillern says that in health the sinuses are sterile and quotes the work of Körner, who, in twenty-one autopsies on bodies dead not more than two hours, found them to be sterile in every instance. But we were not dealing with dead bodies, and it was necessary to study the efficiency of our technic together with the bacteriology of the sinuses. Consequently, all of the children who came into the clinic for chronic tonsillitis and adenoids were

carefully studied for evidence of sinus disease, and those in which the findings were negative were subjected to the same bacteriologic examinations as those in which they were positive.

We found it practicable to concentrate our attention upon the antra because, with the exception of the ethmoid cells, they are the most frequently diseased and the most uniformly developed in young children and of all the nasal sinuses are the most easily accessible. While the child is anesthetized for the purpose of the tonsillectomy the antra can easily be examined without inconvenience or danger.

A trochar is passed into the antrum through the antromeatal wall, and through this a long blunt pointed needle attached to a glass syringe was inserted. One to three cubic centimeters of sterile normal salt solution are thrown into the antrum and drawn out. The solution is forced in and out of the antrum several times, so as to loosen up any pus which might be clinging to the sinus wall. The presence of pus or mucus was noted and cultures were made from the washings.

An effort was made to rule out the possibility of contaminating the antra as much as possible by cleaning the mucous membrane of the nose with pledgets of sterile cotton and washing with 50 per cent alcohol, before passing the trochar through the wall. In a number of cases the middle meatus was painted with a solution of methylen blue, with the idea of ascertaining whether or not the salt solution might flow out through the ostium with positive pressure and be drawn back in again with negative pressure, thereby contaminating the washings. In no case was there the slightest tint of blue obtained in the washings.

If contamination should occur, either at the point of entrance of the trochar or through the ostium during the administration of the anesthesia, the bacteria found in the culture would have been such as are normally found in the nose. In this connection a knowledge of the normal flora of the nose in our native surroundings is of value. In examining the noses of one hundred and sixty nurses in our hospital for diphtheria carriers, record was made of the bacteria present. The staphylococcus was found in every case, an encapsulated diplococcus in seventy-three, diphtheroid bacilli in fifty-nine, micrococcus catarrhalis in seventeen, gram negative bacilli in

ninety-three, bacillus subtilis in seven, and in only three instances the streptococcus pyogenes.

In infants and young children examined, the washings from the antra varied from perfectly clear fluid without any trace of cloudiness to thick white pus which could only with difficulty be drawn through the aspirating needle. In some instances the washings contained varying amounts of clear glary mucus which on microscopic examination was seen to contain no pus cells. In still other cases the antra contained both mucus and pus. Out of the fifty-four apparently normal sinuses examined, pus was found in but two cases and mucus in eight.

As soon as the normal salt solution was aspirated from the antrum the presence or absence of pus and mucus was noted and a small amount of the contents was smeared over the surface of a blood agar plate and the remainder transferred to beef infusion bouillon. Care was taken to use enough media so that it would not be diluted more than 10 per cent by the addition of the washings from the antrum, and not more than 1 per cent or 2 per cent if any considerable amount of pus or mucus was present. For the first thirty or forty cases, two bouillon cultures were made, one an aerobic culture and the other a partial tension culture, but the two gave such uniform results that the partial tension culture was abandoned at this time.

No routine examination of sinuses other than the antra have been made excepting in those instances where it was deemed of especial importance to study the upper and posterior sinuses. These were the cleft palate cases, the arthritic cases, and those cases where an upper or posterior sinus was suspected of being the etiologic factor in some constitutional disorder. Here an attempt was made to determine the bacteriologic conditions of these sinuses by inserting a long slender catheter into the middle meatus and so placing the tip that by suction secretions could be drawn into the catheter just as they flowed from the sinuses. Whatever material was collected in this manner was immediately transferred to the culture media. Naturally, this method is unsatisfactory in that contamination from the lower portion of the nose is sure to take place and that one never feels certain that pathogenic bacteria may not be present in

the sinuses and yet not be obtained in this way. However, in the absence of a better method we feel this procedure to be very useful.

The results of our sinus examinations are summed up in the following table:

	No. of cases	Antra washings, clear	Antra washings contain mucus	Antra washings contain pus	Antra cultures sterile	Antra cult. contain bacteria hemolytic strept. neg.	Antra cult. hem. strept. pure culture	Antra cult. hem. strept. and other bacteria
Clinically antra apparently normal	55	44	3	8	39	13	1	2
Per cent	..	80.	5.4	14.5	70.9	23.6	1.8	3.
Antra would have been considered normal but for blurred X-ray plates	43	25	8	10	24	17	2	....
Per cent	..	58.1	18.6	23.2	55.8	39.5	4.6	....
Positive local evidence of sinusitis. No systemic lesions	12	2	8	2	....	6	3	3
Per cent	..	16.6	66.6	16.6	....	50.	25.	25.
Arthritis cases, conditions presenting, after removal of tonsils, etc.	12	....	10	2	....	....	6*	6
Per cent	..	....	83.3	16.6	....	....	50.	50.
Chronic otorrhea cases	8	3	4	1	5	1	....	2
Per cent	..	37.5	50.	12.5	62.5	12.5	....	25.
Cleft palate cases	7	4	1	2	2	4	....	....
Per cent	..	57.1	14.2	28.5	28.4	57.	....	....
Osteomyelitis cases	3	1	2	....	1	1	1	....
Per cent	..	33.3	66.6	....	33.3	33.3	33.3	....

We had all together fifty-five cases in which, prior to the antra puncture there was no reason, either systemic or local, for suspecting nasal sinusitis. Of these only two, or less than 4 per cent, had pus in the antral washings; 8, or approximately 15 per cent, had clear mucus in the washings, and 44, or 80 per cent, had neither pus nor mucus. In these cases there was a very close similarity between the macroscopic and cultural

*One of these cultures was obtained from the ethmoid cells.

findings, for it may be seen by referring to the table that 39, or 70 per cent, of 55 cases were sterile. That three, or 5 per cent, contained a hemolytic streptococcus, and 24 per cent contained organisms other than hemolytic streptococci.

I have placed in a separate group those cases which gave no definite evidence of sinusitis before the taking of X-ray plates when one or more sinuses were found to be blurred. Of these there were forty-three. The washing of the antra showed no evidence of pus or mucus in 58 per cent. Mucus was present in the washings in 24 per cent of the cases, and in 18 per cent of the cases pus was found. Here again the cultural tests are in close accord with the macroscopic results of the antral washings: 55 per cent of the cultures were sterile, 4.6 per cent contained a hemolytic streptococcus, and the other 40 per cent contained various organisms such as are often found in the nares.

Out of the ninety-eight cases comprising these two groups, cultural tests showed that bacteria were present in the antra in thirty-five cases or altogether in fifty-one antra. Out of this number the staphylococcus was found in forty-five, the pneumococcus in thirteen, unidentified gram negative bacilli in eight, diphtheroid bacilli in seven, micrococcus catarrhalis in seven, hemolytic streptococcus in five, staphylococcus viridans in one, and Friedlander's bacilli in two.

The most interesting group was a series of twelve arthritis cases. These were all cases in which the arthritis had failed to clear up after the removal of the tonsils and adenoids. The source of the trouble was sought in the sinuses. The youngest of these cases was three years old, the oldest thirteen years. The improvement in the joint condition following treatment of the sinuses was in each instance most satisfactory. Here the findings are in marked contrast to those above. Nine of the twelve had definite pus in the antra, two had thick glary mucus, while in the other case thick pus was found in the ethmoid cells, but washings from antra were not obtained. In eleven of these cases a hemolytic streptococcus was found in the accessory nasal sinuses.

The streptococci from this group of cases were tested for their action upon sugars. All fermented lactose and salicin and were without action on mannite and inulin, and were

therefore classified as streptococcus pyogenes. They were also tested for their virulence by inoculating rabbits. Three to four cubic centimeters of forty-eight-hour beef infusion bouillon cultures were injected intravenously into well grown young rabbits. Three of the animals died from acute toxemia in periods varying from one to four days. At autopsy the livers, spleens and kidneys were found to be large and hyperemic, and showed areas of focal degeneration. Two of the rabbits had pneumonia. The streptococcus pyogenes was isolated from the heart blood and from the spleen of all three of these rabbits. Four of the animals survived the acute symptoms and were apparently well, but after periods varying from four to six weeks developed arthritis and were killed. Each one of these four rabbits had one or more knee joints involved. The pathologic changes found in the involved joints were practically identical in every instance. The animal while living held the joint stiff and refused to use it in moving about. The tissues surrounding the joints were swollen and slightly hyperemic; the bursa and synovial sacs contained a marked increased amount of fluid, which was thick and milky, and the synovial membrane was slightly thickened. From the joint fluid of three of these rabbits a hemolytic streptococcus which fermented salicin and lactose was cultured. The cultures from the joints of the other were sterile, however, a gram positive micrococcus arranged in pairs and short chains was found in sections prepared from the tissues surrounding the joint.

In each of these last four rabbits the maxillary sinuses were carefully opened and studied. In two cases both sinuses appeared to be normal. Cultures made from one was sterile, and from the other contained only a sparse growth of staphylococcus. In the other two rabbits the sinuses were definitely diseased; the mucosa was reddened and thickened. Cultures revealed a hemolytic streptococcus in the antra of both.

Two of those chronic diseased rabbits had endocarditis and one of the others a small focal abscess in the wall of the left ventricle. The heart of the other seemed to be free from disease. Unfortunately, microscopic sections were made from the viscera of only two of these rabbits—both showed degenerative parenchymatous changes in the liver, spleen and kid-

neys; in the case of one animal quite marked, in the other, very slight.

The rabbit inoculated from one case of arthritis never developed any symptoms. The dose used was probably too small. Those inoculated from three other cases are yet living, but the requisite time for the development of arthritis has not as yet elapsed.

In the beginning of this work the purpose of animal inoculation was merely to test the virulence of the organism under consideration. When the first animal developed arthritis the idea that the hemolytic streptococcus found so uniformly in the diseased sinuses of arthritis cases might have a selective affinity for joint tissue naturally suggested itself. It now seemed unfortunate that the first four rabbits had died during the acute stages of toxemia. From this time the dose was decreased, and two animals were inoculated, one with four and the other with three cubic centimeters of twenty-four hour cultures of the streptococcus. It was hoped that by this procedure at least one of them would develop chronic symptoms. Four rabbits were also inoculated with hemolytic streptococcus from acute mastoiditis cases, and one with a hemolytic streptococcus from a diseased sinus in a cleft palate case. Two of these also developed arthritis. While our series is as yet to small to warrant the drawing of any definite conclusions it hradly seems probable that any peculiar selective action is here demonstrated.

During this period twelve infants suffering from posterior palate clefts were bacteriologically investigated. We do not operate for the closure of posterior clefts in children until we are sure the nasal sinuses are not infected. Nasal sinus disease, if present, is almost sure to cause sloughing. Haskin's method of treating sinus disease is particularly efficient in this class of cases. In only seven were the antra sufficiently developed to justify an antra puncture's being made. Five of the seven cases had viable bacteria in one or both antra. However, in only one case was the hemolytic streptococcus found. This child had had erysipelas and later developed double mastoiditis. From the mastoid cells pure cultures of hemolytic streptococci were obtained. Of the remaining four cases three had only one diseased antrum. The staphylococcus was

found in all of these, the pneumococcus in two and the streptococcus viridans in one. In the remaining case a clinical examination showed a very evident sinusitis, the nose being continually full of pus and the mucosa red and hypertrophic. Pure cultures of pneumococci were found in both of the antra.

The pneumococci from all three cases were tested for their virulence. In the case of definite sinusitis the animal died of acute toxemia in eighteen hours. A similar dose from the other cases was without apparent effect.

In the five cleft palate cases where cultures were made only from the middle meatus one gave practically a pure culture of hemolytic streptococcus. Organisms from the other four cases were such as are habitually found in the nose.

XXII.

THE COMPLETE EXTIRPATION OF THE LARYNX IN CARCINOMA.

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Up to the present, there has been a great improvement in the radical interference of the larynx, especially since Watson performed this operation in 1866, for the first time. The low mortality in this operation is due to such men as Glück and others who developed a technic for the avoidance of infection and aspiration pneumonia. It may be useless to report my experiences on the technic of this operation, but the observance of a certain amount of care and diligence on the part of the operator will go far in avoiding the numerous complications which might otherwise arise.

In my practice during the past years at the Kioto University Hospital and the Dalny Hospital, I have observed forty-one cases of laryngeal carcinoma, in sixteen of whom there was a complete extirpation of the larynx.

Practically all of these cases which are brought to this operation are, as a rule, aged, and more or less cachectic. Further, the tumor usually involved the cartilage and the surrounding structures as well. In the operation itself, for these reasons, a local anesthesia would be ideal for patients, if we could find some way to anesthetize all the nerves in the field of operation. I have attempted to do this operation in several cases without the use of a general anesthesia, and have obtained very satisfactory results.

The anesthesia is administered as follows: Novocain is injected subcutaneously in a transverse line across the throat, located half way between the mentum and the hyoid bone, about seven centimeters long. The cervical nerves, nervi cutaneous colli, and supraclaviculares are blocked on each side at the posterior edge of the sternocleidomastoid muscle, half

way between the mastoid process and clavicle. In order to make the anesthesia complete, both of the superior laryngeal nerves should be blocked. One can do this by injecting the anesthetic at the mid point of a line drawn between the upper edge of the thyroid cartilage and the lower edge of the hyoid bone. The point is further located on a transverse line passing between this perpendicular line and the midline of the body, at the junction of the lateral third and medial two-thirds. The block here is effective if the patient feels a radiating pain shooting toward the ear on the side corresponding to the injection. After anesthetizing these nerves I inject posteriorly behind the arytenoid and cricoid cartilages and also along the trachea, at a few places if necessary.

For the anesthetic I usually use about 15 cc. of a 0.5 per cent novocain with a few drops of adrenalin. The mucous membrane of the lower part of pharynx, larynx and upper part of the trachea should also be painted or sprayed with a 10 per cent cocain adrenalin solution, for the purpose of stopping the sensation of pain and reflex activities arising from the mucous membrane.

In reference to the incision of the skin, many types have been suggested. The incision shaped like ⊏ or ⊐, giving one large flap attached at the lateral side of the neck, is often recommended, for it does away with a wound in the median line, and hence keeps any secretion from getting into the pharynx and trachea if the original incision does not heal by primary intention. This is a thing to be desired, for these secretions may easily give rise to a bronchitis or delay the healing processes.

I should prefer, however, an incision in the median line which was formerly used more frequently, shaped like the letter I, for it surpasses in many respects the above and gives better results. This incision is not so uncomfortable as generally believed, if care is taken in the postoperative treatment. In comparing this flap with the above, it can easily be seen that we will have a much better blood supply since we have two stalks, while in the above there is of course just one. A wound with two stalks can heal much easier by primary intention, since there is a better blood supply. Not only

this, but the median line incision will avoid nearly all the blood vessels, also.

A separate incision should then be made below the main incision, as recommended by Glück, so as to make it convenient for the patient to breathe. In order to do this, the trachea is loosened from the surrounding structures and lifted up and cut through completely; the end is brought in approximation to the skin and sewed fast. It is to be noted that there is a piece of intact skin between the lower and upper incisions. One can see how this will help to keep the main wound clean, after operation, of any tracheal or pharyngeal secretion. When the procedure is done in the above way we have no fear of asphyxia, dyspnea or aspiration of blood or any other foreign body, and can proceed at ease with the removal of the larynx and tumor.

It will be remembered that the other method of procedure is to cut through, above the tumor, first, and to dissect the larynx and trachea downward, intact. Then the trachea is sectioned below the tumor and sutured in place to the skin as already indicated. This method would make it easy for the patient to aspirate blood or to become partly asphyxiated if the operator is not very careful.

In closing the wound after the removal of the larynx extreme care should be observed in suturing the pharynx, for it is here that all the infections usually take their origin as a result of the fact that the mouth cavity cannot be kept sterile. When sewing the pharyngeal wound I use a double suture for the mucous membrane like that used for the entero-anastomosis. For the intestinal anastomosis the serous coat of one gut is first united to that of the other and then the mucous membranes of the two are stitched together. With the pharynx, after suturing the mucosa, the muscles and fascia are united in place with a double suture and serve the same purpose that the serous coat does to the intestine.

The double suture has the advantage that, if one gives way, the other will still hold the mucosa in place, and it closes the mucous membrane securely and prevents any secretion from getting into the wound proper, which might otherwise prevent primary intention. We should mention here that it is well not to pass the suture through the mucosa completely, but just

through the submucous layer, avoiding, hence, a stitch infection.

After completing the operation the next thing to be considered is the postoperative treatment; the patient is fed, of course, with a catheter, and the pharynx and mouth cavity must be kept very clean until the wound is entirely healed. From time to time a rhinoscopic examination is made and, if necessary, the nasopharyngeal cavity is washed. This is very desirable and necessary, for the patient is no longer able to keep his own nasopharynx clean through coughing or gargling. The mucous membrane of the nasal cavity a few days after operation presents a wrinkled surface on the conchæ, is somewhat anemic in color, as a result of the fact, no duobt, that the passage is no longer used for respiration.

When now the patient has recovered from the operation it is necessary to have some arrangement whereby he will be able to express himself, since the vocal cords are entirely gone and since he no longer breathes through the natural channels. Many means have been developed for this purpose. Among these may be mentioned the artificial larynx as the most improved apparatus, which is so arranged as to send the air from the lungs into the mouth cavity. With the help of this instrument he is able to make a reasonable amount of articulate sound. The apparatus is composed of three parts: one for the trachea, another for the pharynx, and a third for phonation; the phonation tube is attached to the tracheal tube and has a valve in it which will vibrate on expiration. The pharyngeal portion is not necessary if the wound heals by primary intention. A rubber tube is attached to the phonation part of the apparatus, and put either into the mouth or introduced into the external nares down to the choana.

This instrument has a good design, but it is not as practical as one would first suppose, and then the patient is not apt to like these tubes, for he cannot regulate the valve at will. Moreover, the sound produced is always the same, and the instrument requires much effort on the part of the patient in its use. If he talks for any length of time he becomes quite tired as a result of the effort, and also as a result, indirectly, of his old age and weakened condition, and further, the tube, when in the nose, acts as a source of irritation to the mucous

membrane. Most patients who have used this instrument for a few days come to the conclusion that they would rather do without the thing and just express themselves with their lips.

For these reasons I have sought something that would be more practical for the patient, and have found that a simple rubber tube will serve the purpose admirably. This tube can be carried in the pocket, and when it is used one end is attached to a piece of metal tubing which just fits on to the trachea, while the other is held in the mouth, and in this way air can pass into the pharynx. Thus, with the help of the lips, teeth, tongue, palate, and pharyngeal muscles, a whisper can be produced just as is done by a normal person. Upon inspiration the patient must lift the tube to the side of the trachea and replace it at expiration.

Usually one week's training will be enough for the patient to make himself understood. One of my cases was able to visit me, after leaving the hospital, making a long trip alone, and relying on this tube for all his intercourse with the public. Another case which I demonstrated in the Kioto Medical Assembly, made a short speech in a hall, and the listeners were surprised that they could understand what the patient was saying.

This finishes our discussion of the operation itself, but it may be well to briefly review the clinical material. Most of our cases were males, there being only two females among forty-one patients, and all being sixty years old. The nature of the complaint depends, of course, on the situation and state of development of the tumor. An impairment of voice is complained of, and the patient has a feeling of the presence of a foreign body in the throat; hemorrhages occur from time to time, and there is more or less pain, which often shoots in the direction of the ear, and is especially marked when food or saliva is swallowed. A cough is usually present with frequent expectoration, which has a fetid odor when necrosis occurs.

The most important symptom, however, is the change of the voice to aphonia from the beginning of the disease; it is often the only symptom observed for several months or for more than a year. The pain is quite indefinite. As is known in carcinoma of the larynx, the pain is much less frequent and

severe than in tuberculosis. Among sixteen cases of complete extirpation eleven had not shown even the slightest pain up to the time of operation. The absence of pain should always be remembered when making a diagnosis; it is often absent in the early stage of the disease, at the time when a diagnosis of malignancy, if possible, should be made.

The patients, however, in the early stage do not present themselves to a physician, and when they do are often just thought to have mere colds, thereby losing their chances for early operation. A man, specially trained in this affliction, never as a rule, for these reasons, sees the patients until late. On the other hand, a surgical interference still I do not consider the ideal method of treatment, but I am sorry to say is the only one which gives relief, and its success at present depends on an early diagnosis. The X-ray, radium or medicinal therapies do not seem to give much success, but may sometimes be useful following the surgical interference.

Of the sixteen cases operated there was recurrence in eight and no recurrence in the other eight after a lapse of three to four years, with no mortality during or following the operation. The recurrences could be diminished, possibly, if the patients came earlier for treatment.

When determining the localization of the tumor clinically there is often much difficulty, owing to its more or less diffuse nature. From the view obtained with the laryngoscope the location of the oldest point of the tumor can sometimes be made out. In nine cases it was located on or lateral to the false vocal cords, while in six others it was located on both true and false vocal cords and extended to the sinus pyriformis and sometimes up to the epiglottis. It occurs as frequently on the left as on the right side.

SUMMARY.

1. The complete laryngeal extirpation can be easily done under local anesthesia with good results.
2. Better results are obtained when there are two flaps in the skin incision, each having its stalk in the side of the neck, than when there is only one large flap with one base.
3. It is more successful to section the trachea below the

larynx and arrange for safe respiration before removing the tumor.

4. The pharyngeal wound is sewed with a double suture, but the mucous membrane is approximated in the submucous layer.

5. Between the main laryngeal wound and the opening of the trachea we should have a bridge of intact skin, as Grueck suggested.

6. At all times the nasopharyngeal cavity must be kept clean after removal of larynx.

7. For the purpose of conversation after extirpation, a simple rubber tube is used, one end being introduced into the trachea, while the other end is held in the mouth. This tube enables the patient to whisper with the help of his lips, teeth, tongue, palate, and pharyngeal muscles. The tube, in my experience, is much easier to use than the modern complicated artificial larynx and is better liked by the patient.

8. Most of our patients were males, all being about sixty years old. The localization of the tumor as seen with a laryngoscope was chiefly on the false vocal cords.

9. The percentage of permanent cures in our sixteen cases was 50, while there was also 50 per cent recurrence, with no mortality during or following the operation.

10. The earliest and most common symptom in this disease is the hoarseness of the voice, and it frequently remains as the only symptom for a long time, while pain is complained of in but a few cases.

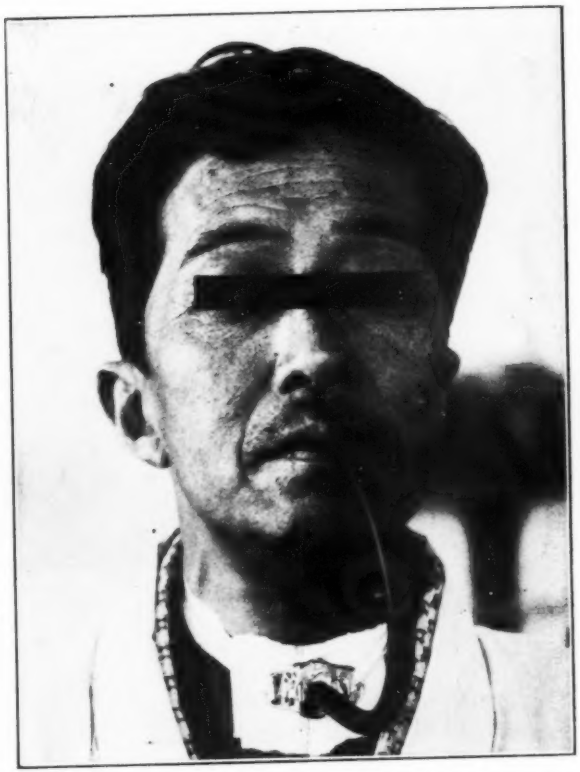

Fig. 1. Patient after removal of larynx.

Fig. 2. Tumor extirpated from the patient.

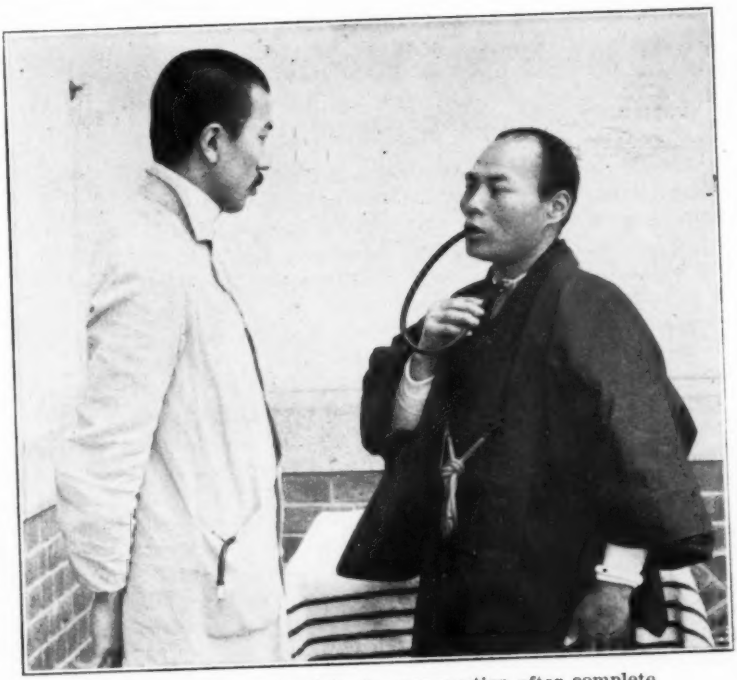

Fig. 3. Patient using tube in conversation after complete extirpation of larynx.

XXIII.

AN OPERATION FOR THE PRESERVATION OF THE MUCOPERIOSTEUM IN RESECTION OF A PORTION OF THE MAXILLA.

By T. Hoshino, M. D., and K. Ota, M. D.,

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When there has been a resection of the palatal portions of the maxillæ, the patient usually has much disturbance in speaking and eating, due to the fact that there is a communication between the mouth and nasal cavity. The air can easily go up through this passage while speaking, and in swallowing, food often enters the nares, causing much discomfort. In order to overcome that discomfort it has been customary to supply the patient with a prosthesis after operation, but it seems to us that it might be possible, in certain cases, to do away entirely with such disagreeable results.

According to the prevailing custom, surgeons sometimes neglect the function of the nose and palate when they remove this part of the maxilla. They often prefer to introduce a saw into the nostril and then just resect bone and mucosa completely, since it is much easier to do the operation in this way. Indeed in most books and journals on surgery up to the present, this operation is always recommended.

If it can be determined, however, that the nasal cavity has not yet been invaded by the tumor, it would, to be sure, be quite an advantage from a physiologic point of view, to keep the nasal cavity intact. *Brophy also speaks of this in his oral surgery.

The following report is a case we operated, and we hope it might be of some help in preventing a communication between the mouth and nasal cavity in resection of a portion of the maxilla.

N. N., male, aged sixty-eight years. The man has always

*Truman W. Brophy: Oral Surgery, 1917, p. 916.

been in sound health since childhood. Has increasing hard hearing and sometimes tinnitus. He has lost nearly all teeth during last four to five years, having only first upper right molar left. Has never had toothache. Smokes and drinks moderately.

About five months ago he accidentally noticed a hard tumor mass, about the size of a hazelnut, on the upper gum, slightly to the left of the median line. It increased in size slowly at first, but during the last two months has grown more rapidly. He has no pain, but complains chiefly of a disturbance of speech and a marked discomfort in taking food.

Present condition: Patient is of medium height. Physical examination shows no abnormal findings in the organs of the thorax and abdomen. Temperature is normal. Urine negative.

Local examination with anterior and posterior rhinoscopy: No changes in nasal and accessory sinuses could be noted, especially in the anterior floor of the inferior nasal meatuses. In the mouth cavity, anteriorly, there is a tumor about the size of a hen's egg, on the left upper alveolar process; it extends posteriorly for one-third the distance of the hard palate. It measures 6 cm. across, front to back and from side to side, and is 2.5 cm. in height. The surface is uneven, due to furrows running in all directions; it is yellowish, fleshlike in color with scattered black spots. The upper lip is pushed by the tumor upward and forward, and patient is unable to close his mouth and lips completely. When in the act of deglutition the tongue pushes the food out of the mouth rather than down to the esophagus; saliva flows out of the mouth, and it is hard to make himself understood. A skiagraph in frontal and lateral views outlined the borders of the tumor as involving the lower two-thirds of the alveolar process and the anterior third of the hard palate.

Histologic Findings.—When a small part of the tumor mass was excised and examined under the microscope it showed many islands of spindle cell masses bordered by much fibrous tissue. The black spots noted macroscopically contained melanin pagment, about which there were more or less degenerative processes. The nuclei of the tumor cells about the melanin pigment were stained faintly with hematoxylin, and they ex-

hibited some fatty degeneration, as shown by Sudan III. No giant cells were present. Only a few blood vessels were observed in the tumor, and when seen had a very thin coat.

The diagnosis, therefore, from a histologic point of view is a melanofibrosarcoma of the alveolar process of the maxilla. It may be called also an epulis. Any tumor in this part of the body is called epulis, usually, by clinicians. The reason epulis is applied to any kind of tumor here is partly dependent on the fact that even though it shows malignant structure like a sarcoma, it has little tendency for metastasis and remains for a long time as a mere benign tumor, and further, when removed, there is little tendency for recurrence. These points seem to indicate that a sarcoma of the alveolar process of the maxilla is often different from a sarcoma appearing at other places. But the term epulis is really just a general name, for it does not signify any particular kind of neoplasm, and it would be better, therefore, to replace this word with one that will give the histopathologic nature of the tumor.

The operation was performed with the patient in a sitting posture and under local anesthesia. The left external carotid artery was ligated, and then a transverse incision was made across the alveolar process of the maxillæ down to the bone and the periosteum elevated so as to expose the field of operation. Since the nasal cavity was not invaded by the tumor, we merely lifted the periosteum from the floor and lateral wall of the left nasal cavity with a periosteal elevator. The instrument was placed at the edge of the apertura nasi beneath the mucoperiosteum and then denuded from the underlying bone. The tumor was chiseled away from the healthy bone, thus leaving only the mucoperiosteum for the floor and lateral wall of the nasal cavity. It was necessary to remove the anterior part of the alveolar process from the incisor tooth on the right side to the first molar tooth on the left side and also the anterior half of the hard palate. In addition, one-third of the median wall of the antrum of Highmore was removed, but the mucosa of the sinus was not disturbed. We next loosened the oral mucous membrane on the remaining portion of the hard palate, and that on the upper lip, and then approximated these to the edges of the wound. This left a small wound in the roof of the mouth which had to heal by a process of gran-

ulation from the surrounding edges of the mucosa, while the nasal cavity was covered entirely by the mucoperiosteum.

The patient recovered in sixteen days without any complications, and when the wound healed, he had nothing between the roof of the mouth and nasal cavity except mucous membrane and intervening soft tissues, and the man is able to talk and is able to swallow food without any of it passing into the nares.

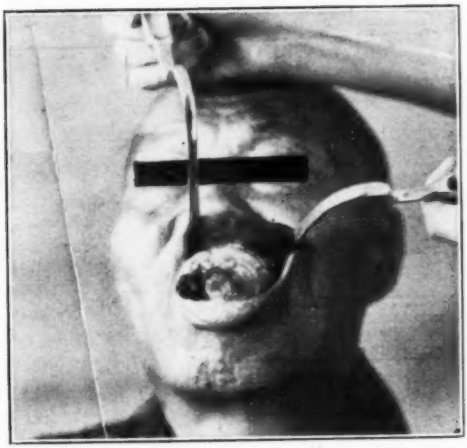

Fig 1. Tumor before removal.

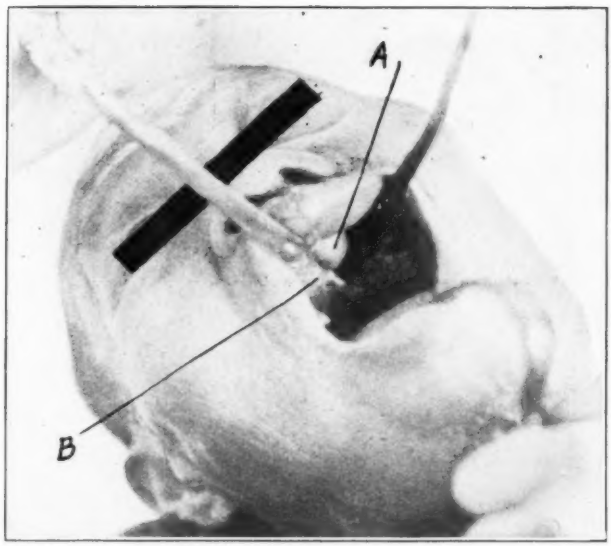

Fig. 2. Photograph following excision.
A. New roof of the mouth composed of mucoperiosteum.
B. Normal remaining hard palate on the right side.

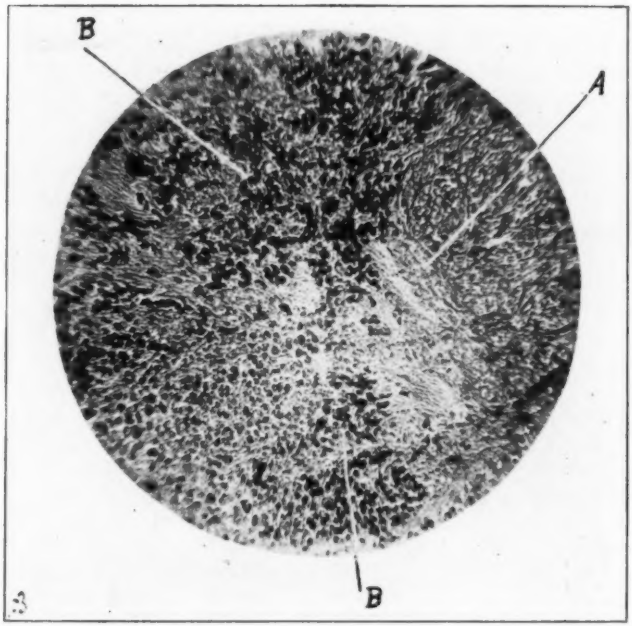

Fig. 3. Histologic preparation of tumor.
A. Sarcomatous tissue.
B. Tumor tissue containing melanin.

XXIV.

IMPAIRED HEARING FOLLOWING A PARALYSIS OF THE NERVUS ABDUCENS.

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From time to time reports have been made on paralysis of the sixth cranial nerve following or associated with disturbances of the ear, especially the middle ear by such men as Tomasi[1], Poli[2], Citteli[3], Gradenigo[4], Alt[5], Noltenius[6], Urbantschitsch[7], Ostmann[8], Dorello[9], Blanc[10], Mawthner[11], Ruttin[12], Tacques[13], Török[14], Schwartze[15], Moos[16], Habermann[17], Hilgermann[18], Högyes[19], Bernheimer[20], Knapp[21], Baldenweck[22], Rimini[23], Maruyama[24], Perkins[25], Nagaoka[26], Wheeler[27], and others. Almost all cases in these reports had, from the beginning of the paralysis, more or less involvement of the middle ear or the structures which are closely related to it, such as, for example, the mastoid cells, the eustachian tube, cranial blood sinuses or the temporal bones.

From the review of the literature at our hands a case in which disturbance of hearing follows a paralysis of the sixth cranial nerve with no apparent focal infection, or any disease of the middle ear and its related structures, seems to be quite rare or else has not been observed.

The following is a case, we observed, in which impaired hearing and tinnitus followed in the course of paralysis of the abducens nerve.

H. T., age 42, male, married, railway man. According to the patient's statement, his father died from excessive use of alcohol; mother dead; cause unknown. Has one child who is living and well. Patient has always been well except that when twelve years old, he had measles and when eighteen he contracted a Neisserian infection. He denies syphilis.

Twelve years ago while he was playing, a shot gun which he believed unloaded, accidentally went off burning his left cheek, and penetrating the left mandible. An incision was made into the cheek for the purpose of taking the lead out

of his mandible and he now has a large scar on the side of his face. Since that operation he has had trismus to some extent. There is no history of any disorder in his ear or nose in the past, as a result of the accident.

History of Present Complaint.—A few weeks ago, while working he noticed that he had diplopia, but complained of no other symptoms. This double vision became worse and in the week that he first noticed the diplopia, he visited our hospital and a diagnosis was made of a paralysis of the right abducens, in the eye clinic. His vision at that time in both eyes was 20/20, with no changes in the fundus oculi. No other motor nerves of the eye were involved. He has double vision when he looks either to the right or left, but it is more marked when he looks to the right. The patient is not able to move the right eye to the right at all.

In spite of all treatment in the eye clinic, thirteen days after his trouble started, he began to have severe pain, sometimes shooting in character in the temporal and mandibular parts of the right side of the face. At the same time he developed hard hearing, and intense tinnitus on the right side, which resembled the ringing of a bell.

With this history and complaint the patient was turned over to us by the eye men just two weeks after the beginning of his diplopia. The tinnitus increased, and sounded eventually to the patient like the note of a flute. There is no history of fever or vertigo. The pain, however, in the right parietal and frontal regions is associated with hyperesthesia, and when the finger is pressed over the supraorbital notch, or over the temporal fossa an exquisite pain is produced.

The man is of medium size with large bones, well nourished, pulse 65. The arteries show no sclerosis. On the left side of the face, he has a scar five centimeters long running across the angle of the mandible. The mandibular joints are passively movable, and it can easily be seen that his limited ability to open the mouth is due to cicatricial contraction of skin and muscles of mastication, and not due to any ankylosis of of the mandibular joint.

The organs of the thorax and abdomen exhibit normal conditions. Sensibility and motility of extremities are good. Patellar reflex present and normal. Urine is negative.

Eyes: Conjunctivæ, cornæ, lacrimal sac, and iris are normal. Sight normal. Pupils equal, and react to light and accommodation. No pathological condition is present in the orbital cavity. The movement of the left eye is good, but the right is fixed with the eyeball turned toward the median line, and the patient has no ability to move the eye outward.

Nose: Some dry material is adherent to the mucous membrane but gives no odor and is no doubt just the remains of the natural secretion. The accessory nasal sinuses are not tender or inflamed.

The muscles supplied by the facial nerve show no paralysis. A slight catarrh of the mouth is present. Stenson's ducts are patent on both sides, even on the left, in spite of the cicatricial tissue. At a point just beneath the zygomatic arch, immediately in front of the mandibular joint, he is tender to pressure.

Ear: Examination of middle ear and its surrounding structures exhibits no pathologic conditions, but are entirely normal, except that both tympanic membranes are retracted inward and somewhat thickened and opaque. The mastoid processes are not tender, and there is no trace of an old mastoiditis. Griesinger's and Gerhardt's signs negative. The nerves which pass through the jugular foramen show no paralytic conditions. No symptons are present which could arise from an involvement of the transverse or cavernous sinuses or jugular vein. Air could easily be blown into the eustachian tube, and there followed no effects of disturbed hearing or tinnitus. When one passes the finger under pressure up or down along the carotid artery on the side corresponding to that of the abducens paralysis there results no change in the quality of the tinnitus above which he has always complained of during the last few days.

The functional hearing test revealed the following findings: The Weber test is given on the uninvolved side, while Schwabach test is decidedly shortened in the involved ear, but normal in the left. Rinné is negative on the right. The tuning forks give negative results with C_3, C_4, Fis_4 in the right ear, while the others, of lower vibrations, could be heard. The left ear is normal in reference to all the tuning fork vibrations. On the right side, he is completely unable to hear a watch.

Examination of the vestibular apparatus: There is no spontaneous nystagmus. Romberg sign is negative, i. e., no coördination disturbances are present when the patient stands with his eye open or closed. The rotation and the caloric tests exhibited nothing abnormal.

From the above results of the examinations of the functions of the ear, we can conclude that the seat of the disorder in this patient is not located in the sound conduction apparatus, but either in the cochlea or most likely some place along the cochlear nerve.

Nothing is revealed by a roentgenogram of the head except that on the border line of the superior angle of the pyramid of the right temporal bone there is a light shadow somewhat enlarged so that the upper border of the pyramid does not appear as sharp as it does on the left side.

With the examination thus far conducted we were unable to reach a diagnosis, but when a Wassermann was made it was found to be three plus.

Then when energetic antiluetic treatment was instituted, consisting of mercurial inunctions, potassium iodid and two injections of neosalvarsan, there was a prompt improvement. Indeed, after sixteen days of this treatment the tinnitus and the pain in the right side of the face and head totally disappeared. The movement of the right eye became free, although not perfect, and the patient no longer complained of double vision when he looked towards the left. The results of the hearing tests were also better. Weber lateralized to the left side, Rinné positive on both sides, shortening of Schwabach has disappeared, and now is normal on each side. Tuning forks A, C, C_1, C_2, C_3, C_4, Fis_4 could all be heard on the right side. Watch: Left 200/200 centimeters; Right 10/200 centimeters.

Further, after 56 days from the outset of the disease, that is, 35 days after the beginning of antiluetic treatment, the patient recovered his hearing completely as the repeated tests showed. A watch could be heard at the same distance from the right side as from the left. There remained, however, a lateralization of the Weber to the left. The diplopia is almost entirely absent, being only present when looking to the extreme right.

From the above case we may conclude that the inability to hear high pitched vibrations, and tinnitus with the hyperesthesia and shooting pains in the course of a paralysis of the sixth cranial nerve of one side only. Since the Wassermann was strongly positive, and since there was a prompt disappearance of all the symptoms associated with the three nerves, abducens, cochlear and trigeminal, as soon as antiluetic treatment was instituted, we can only conclude that his condition was syphilitic. Indeed, it is known that paralysis of the abducens nerve as a result of syphilis is not rare[30], [31], [32].

It may now be interesting to go here, into the location of the lesion which occurred in this case. The exact localization will of course be difficult, owing to the fact that the subject did not come to autopsy. So far as we can deduce, however, from the several observations made: the figures of paralysis, healing processes, relationship of each involved nerve, the characters of the disturbances in hearing, and other symptoms, as well as from anatomic relations on the one hand, and references on the other, a probable diagnosis may be established.

As it is known, the abducens nerve has a cortical center supposedly in the cortex of the gyrus angularis[20], [31], and from there fibers are said to go down anteriorly to the aqueductus Sylvi, and to enter the nuclei in the pons, one portion decussating, while the other remains on the same side. The nucleus of the sixth nerve is located in the floor of the fourth ventricle, near the colliculus facialis closely surrounded by the fibers of the seventh nerve. Just lateral, and ventral and also anteriorly to the abducens nucleus, we have the motor fifth nucleus; while the sensory center of the fifth nerve is still more lateral and ventral and runs posteriorly into the cord as the tractus spinalis nervi trigemini. The second neuron of the abducens nerve arising in its nucleus, passes ventrally and leaves the brain stem at the ventral border of the pons. It then passes through the dura mater just behind the tip of the petrous portion of the temporal bone, and then enters the lateral wall of the cavernous sinus together with the ophthalmic division of the fifth, the trochlear, and oculomotor nerves, and finally reaches the orbital cavity to be distributed to the external rectus muscle.

Thus we see that the nucleus of the abducens nerve is located at some distance from the sensory trigeminal center, and from the nuclei cochleares. On the other hand, at the place where the abducens nerve perforates the dura, just behind the tip of the petrous pyramid, the nervus trigeminus and acusticofacialis are closely located.

If we consider the paralysis of the nervus abducens as a result of a middle ear affection, as is often done, we immediately come to a conclusion that this cannot be, for there was no involvement of the middle ear and its surrounding structures, as was shown by the examination of the mastoid cells, eustachian tube, cranial blood sinuses, and internal ear.

The lesion may, possibly, be located within the internal auditory meatus. The acoustic nerve here runs with the facial and since the latter showed no changes, it is hardly possible that the lesion is here, but must be some other place more centrally.

On the other hand, the lesion is not on the peripheral end of the abducens, as for example, in the muscles of the orbital cavity, or cavernous sinus, for there are no symptoms which could lead one to such a conclusion. If it were in the orbital cavity, it would necessarily show other symptoms than those observed. It may, however, be in the cavernous sinus, but the oculomotor or trochlear nerves exhibit no involvement.

We may now exclude the possibility of the seat of the lesion as being either in the orbital cavity, or cavernous sinus, or even any place peripheral to the internal auditory meatus on the path of the acoustic nerve, and must seek it some place immediately about the brain. An affection of the cortical center of the n. acusticus is hardly thought of in this case; first, because of the rarity of such a lesion, and second, because the center on one side gives origin to nerve fibers which go to both sides. This immediately disposes of such a lesion, for the patient had only trouble on one side. In the same way, we can dispose of a lesion about the cortical center of the abducens from an anatomic point of view and from Bernheimer's experiment[20] which proves that stimulation of the center on one side causes a response in both eyeballs.

As for the nuclear paralysis of the abducens in the brain stem, Hirsch[34] reports that in ninety per cent of the pons

affections, one sided paralysis of the abducens is associated with paralysis of the internal rectus on the opposite side. Forster[37] says that when there is a lesion in the floor of the fourth ventricle involving the sixth nucleus there is usually present facial paralysis owing to the close relationship of the sixth nucleus with that of the seventh. The arguments of these authors lead one to believe that the affection of the abducens is peripheral to its nucleus. Of course, it is not easy to differentiate the nuclear affections from those lesions along the course of the nerve, especially only from the symptoms. The lesion may be in the nucleus or along the course of the intracranial fibers of the abducens. We cannot exclude these possibilities all together. However, if we consider the other two nerves, that is, the acoustic and trigeminal, we know that the lesion is some place where these three nerves are close together; for it is hardly possible that an isolated lesion could be on each of these three nerves independently.

The lesion then, in all probability is on the posterior surface of the petrous portion of the temporal bone, where these three nerves leave the brain stem and pass through the dura mater, and this conclusion is further borne out, when we remember that the meninges about the base of the brain are frequent locations for syphilis.

SUMMARY.

1. The subject had hearing disturbances of high pitched sounds, tinnitus of high character, and hyperesthesia in the region of distribution of the trigeminal nerve, in the course of an abducens paralysis, all occurring on the same side, and in a little less time than two weeks.

2. Accurate examinations of the middle ear and its related structures and the internal ear showed normal condition.

3. All symptoms from the abducens, trigeminal and cochlear nerves must have been caused by the syphilitic affection.

4. The localization of the lesion in this case may be supposed to be in the meninges behind the petrous portion of the temporal bone, and involving those portions which are pierced by these three nerves.

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XXV.

A STUDY OF THE AURAL COMPLICATIONS OF THE RECENT INFLUENZA EPIDEMIC WITH SPECIAL REFERENCE TO THE CLINICAL PICTURE.

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The recent epidemic of influenza has shown certain very interesting features from an otologic standpoint. Otitis media was not a very frequent complication, but those cases in which it did develop were of a perfectly characteristic type and showed the clinical picture we had come to consider as influenzal. There were, however, some unique features which are well worth considering.

Out of a series of 6,870 cases of influenza occurring at the U. S. A. General Hospital No. 14, there were only 120 cases of acute suppurative otitis media. There were 1,600 cases of pneumonia in this series and 66 of the cases of otitis media occurred among these. Of the 120 cases, 17 were bilateral, 16 of these occurring in the pneumonias; 21 cases developed mastoids, 2 of these being bilateral; one case developed otitic meningitis and died. The percentage of influenza which developed acute, suppurative otitis media as a complication was 1.75. About 50 per cent of these occurred in cases having pneumonia, the percentage of these being 4.12. The percentage occurring in cases uncomplicated by pneumonia was 1.02. Of the series of 6,870 cases, there were 6 cases of acute frontal sinusitis and 3 of ethmoiditis. No maxillary sinusitis was noted. There were 16 cases of acute laryngitis, 16 cases of acute follicular tonsillitis and one of peritonsillar abscess. There was a small number of acute catarrhal otitis media reported. For acute respiratory diseases this seemed to be a small percentage of aural complications. It is safe to say that none of these were overlooked, as these cases were under con-

stant observation and there were always competent otologists available to examine suspected cases. Each case was seen early and immediate treatment instituted. However, there are certain grounds for error in these figures as on the day they were compiled, there were 173 cases of influenza still in the hospital and potential subjects of aural complications. We must conclude from these figures that the percentage of otitis media occurring in influenza is comparatively small, the greater proportion occurring in those cases complicated by pneumonia.

However, those cases of otitis media which did develop, as a result of influenza, showed certain very interesting, if not unique features. In practically every case the type ran true to form. They seemed to show a distinct pathology, such that it was necessary for us to revise our old symptomatology. This pathologic condition seems to be best described as an acute hyperplasia, or hyperplastic edema of the mucous membrane of the middle ear. The onset was quite sudden, generally occurring in from the first to the third day of the disease. A certain number of cases of otitis media showed clinical pictures identical with those in the influenza cases, but had absolutely no other manifestations of the disease. They reported to the hospital showing what we came to regard as influenzal otitis media and were treated as such, but of course were never diagnosed as influenza.

The first symptom was intense pain in the infected ear together with, or sometimes preceded by, a feeling of fullness. The headache and malaise occurring in these cases must be attributed to the general effect of the influenza and the temperature, which ran from 101 to 104, must be considered in the same way. The otitis media of this type, but occurring in otherwise non-influenza cases, ran a normal temperature. Otoscopic examination of the case within two or three hours after the onset of pain would show distinctive changes in the membrana tympani, always of a vesicular type. In almost every case there was marked redness and some bulging of Shrapnell's membrane. There was injection along the handle of the malleus. The light reflex was usually present and often the anterior portion of the membrana tympani appeared quite normal. The superior posterior quadrant showed the greatest change. There was frequently a large hemorrhagic bleb bulg-

ing outward even for two or three mms. The short process often could be seen. This was the typical early case seen within two or three hours after onset.

The cases seen later showed more swelling, especially of the superior posterior portion, diffuse reddening of the membrana tympani and loss of all normal landmarks. The distinctive feature was a bleb formation. Often there were two or three of these, always superior, either anteriorly or posteriorly and often dissected marginward beyond the annulus and to the wall of the external auditory meatus. These were of considerable size, often being five or six mm. in diameter, obscuring a good view of the membrana tympani. The eccentric layer of the squamous cell epithelium making up the stratum cutaneum of the membrana tympani readily explains this travelling of the blebs laterally to the canal wall. There was no tenderness over the mastoid process at this stage. Incision of the blebs evacuated a small amount of bloody serum. In the older cases this could be expressed from the vesicles only with some effort, as if some clotting or organization was taking place. These blebs were true vesicles beneath the stratum cutaneum of the membrana tympani. After evacuation of these, the drum appeared red and swollen with the marked involvement of Shrapnell's membrane previously mentioned—the degree or extent depending upon the time involved. Incision of the membrana tympani in the earlier cases gave relief to increased pressure within the middle ear, followed by considerable bleeding. Later, this became a profuse, serosanguinous discharge. In the cases seen at a more advanced stage, incision evacuated this serosanguinous discharge immediately.

The pain generally subsided about two hours after the incision of the membrana tympani. The serosanguinous discharge continued rather profusely for several days, then gradually changed in character to a thin purulent discharge which later became of thicker consistency, apparently due to secondary infection.

The nose and throat examination of these cases showed considerable congestion of the mucous membrane throughout, with more or less purulent secretion in the epipharynx, and a diffuse, acute pharyngitis. As epistaxis was a fairly frequent

incident with influenza, occasional excoriations and scabs were seen on the nasal septum, anteriorly in Kisselbach's area.

Occasionally there was laryngeal involvement—a diffuse, inflammatory process involving the false cords and epiglottis with varying degrees of swelling and redness of the true cords and consequent limitation of motion. In some cases it was quite impossible to see the cords. Two cases showed hemorrhagic vesicles of the true cord. These were unilateral and situated about the junction of the anterior and middle third. Later these ruptured and gave the appearance of superficial ulcerations about 3 mms. in diameter. These healed up with treatment in about ten to twelve days.

Presumably we had a very acute, suppurative otitis media, rapid in onset, of nasopharyngeal origin. Almost from the onset a marked epitympanic involvement became noted. An outstanding feature was the early obliteration of the superior angle of the external auditory canal and membrana tympani, sometimes seen on the second day of the disease. With this there was increased swelling of the membrana tympani itself, and often further bleb of vesicle formation, though after incision of the drum, no new extramarginal blebs were seen. With the obliteration of the superior angle, Shrapnell's membrane became pushed downward. The line of incision frequently was depressed inward by the increased thickness or swelling of the membrana tympani. Often a bleb or vesicle would protrude out through the incision.

One case showed a large bleb in the upper limit of a right angle incision of the membrana tympani. The process was apparently a subsiding one and this was not disturbed. The next day this incision was smaller and the bleb had a balloon-like appearance. This became a pedunculated sac of a considerable length, but narrow pedicle, which gradually became choked off altogether with a final closure of the opening. This was removed and gave a macroscopic appearance of mucous membrane.

Generally, there was what seemed to be a hyperplasia of the mucous membrane of the middle ear. Sometimes this protruding through the opening of the membrana tympani would give the appearance of granulation tissue, except that it did not bleed so easily. In one case this hyperplastic tissue coming

through the membrana tympani high up, dissected away the superior angle of the drum, giving the appearance of a polypoid mass. This was freely movable without discomfort to the patient and did not bleed. Upon subsiding, this gave a rough hubbly appearance to the membrana tympani. The serous discharge showed considerable tendency to coagulate, especially over the incision and it was frequently necessary to remove this to allow drainage. Frequently secondary incisions were required. Mastoid tenderness or edema was not evidenced at this stage. In certain of the cases, the process now began to subside and go on to an uneventful convalescence. The discharge ceased and the middle ear began to resolve with reappearance of the normal landmarks and the obliteration of the incision. The last remaining sign of the infection was the irregular thickening and swelling of the superior posterior quadrant of the membrana tympani, giving it an uneven, hubbly appearance.

In other cases, in from ten to twelve days from the onset, the whole superior canal wall would become flattened. This was so marked as to be an absolute drooping and occurred in practically every case with occasional pushing forward of the posterior canal wall at its innermost portion. By this time the discharge had changed in character to thin purulent. Thus, the typical clinical picture would be, a suppurative otitis media of ten to twelve days' duration, showing a thin purulent discharge and absolutely flat superior canal wall, the membrana tympani red and swollen, especially in the superior portion, with or without bleb formation, and all normal landmarks obliterated. Usually there was no mastoid tenderness or edema.

Hitherto, the flattened superior canal wall has been considered one of the most reliable signs of a suppurative mastoiditis and frequently an indication for operation. In these cases we found the reverse to be true, both by clinical observation and X-rays and—alas—by operation, disclosing in one case a normal mastoid and moderately congested ones in two cases.

X-ray examinations of cases at this stage, showed simply a slight obscuring of the mastoid, as well as a cloudiness about the antrum, or a normal cell picture. Destruction of the cell

walls was not shown. Cultures carefully taken and plated upon blood agar showed growths of streptococci in practically every case. Occasionally an admixture of staphylococci was also found.

From this point the cases varied somewhat. In many there was a lessening of the discharge which, however, persisted in smaller degree for a week or ten days. The middle ear gradually resolved and landmarks appeared. About the last sign to disappear was the flattened superior canal wall. Even after the membrana tympani had regained almost normal appearance and color, a certain percentage ran along for several days without showing much change, and then, with some increase in the discharge, there was a distinct thickening of the mastoid periosteum with occasional slight tenderness and edema over the tip. Sometimes these showed a slight rise in temperature and complained of pain at night. They were diagnosed as mastoiditis and confirmed by operation. Some cases, notably in the pneumonias, showed a thick, creamy, purulent discharge, increased in amount, and a definite boggy appearance of the membrana tympani. There was no mastoid tenderness but always a thickening of the periosteum. These also came to operation as mastoiditis.

Of the 21 cases which came to mastoid operation, one showed a normal mastoid, two simply a congestion of the mucous membrane of the cells, while the rest were pretty much of a characteristic type. They showed a hemorrhagic cortex which, upon removal, revealed more or less free pus. The bone was not broken down. In all cases the cell structure was preserved, though somewhat softened. Often there were granulations in the cells. Frequently there was considerable involvement of the zygomatic cells. In some cases the bone over the lateral sinus was rather soft, but not broken down. In two cases there was erosion of the tegmen antri. For the most part, these cases had uneventful convalescence, the middle ear becoming dry within two or three days and the wound healing nicely. One of the cases mentioned above, with erosion of the tegmen, developed a plastic leptomeningitis and died. This was complicated by a severe pneumonic process involving both lungs.

Blood cultures were taken in some of these cases and were

sterile except in one which showed a growth of streptococcus. This was a double mastoiditis in a severe case of lobular pneumonia, followed by a fibrinous pleurisy. This case was admitted to the hospital Oct. 10, 1918, with a diagnosis of bronchial pneumonia, influenza type. He had a severe course of pulmonary involvement. On October 26th, he complained of pain in both ears. Otoscopic examination showed both membrana tympani bulging and considerable redness of Shrapnell's membrane and injection of the handle. Incision evacuated seropus. Two days later he developed a fibrinous pleurisy of the right lower lobe, and on the 20th, 20 ccs. of turbid fluid was withdrawn from the plural cavity. His otitis media ran the usual course until about the tenth day after onset, when the discharge was increased and it became purulent in character. The superior canal walls were flat, the membrana tympani swollen and boggy and there was tenderness and some edema over the mastoids. His temperature averaged about 101 P. M. and his lungs showed considerable involvement. Two days later it was deemed necessary to operate and a double mastoid operation was performed under nitrous oxid gas and oxygen anesthesia. Both mastoids showed a hemorrhagic cortex with some free pus. The cells were not broken down, but were somewhat softened. The mastoids were completely exenterated with no exposure of the sinus or dura. Two days later both middle ears were dry and the wounds clean. On the third day the temperature rose to 104 in the afternoon. There was no history of any chill. White blood count 38,000; differential, polymorphonuclear 92, small mononuclear 5, large mononuclear 3. Examination of fundi negative. Throat negative. Examination of lungs showed: "Total absence of breast sounds right lower lobe, posteriorly, dull to sixth rib." The next day he was somewhat better and two days later his white blood count was 10,900; differential polymorphonuclear 84, small mononuclear 12, large mononuclear 3, transitional 1. Blood culture taken 48 hours previously showed a growth of streptococci. The next day, white blood count was 7,000, Polymorphonuclear 74, small mononuclear 18, large mononuclear 7, transitional 1. His temperature gradually came down by lysis and was normal on the fourth day. There was a question as to whether this temperature was due to the involve-

ment of either one of the sinuses or to the pulmonary condition. The medical consultants felt that all these cases of influenza-pneumonia were bacteremias and that the blood picture might be due to this. He was observed and studied very carefully. Further operative procedure was of course unnecessary.

Here we had a very acute type of otitis media. The only organism obtained was streptococcus. The onset was sudden and marked with intense pain. The otoscopic picture was of the textbook influenzal type; vesicular condition of the membrana tympani, with intense ballooning and large blebs travelling beyond the margins of the drum to the canal wall. At first the process was confined to the superior posterior portion of the membrana tympani and Shrapnell's membrane, but soon the whole drum became involved. The discharge was serosanguinous, later purulent. The swelling of the upper part of the membrana tympani with later protusion of the mucous membrane, can best be explained as an acute hyperplastic condition of this mucous membrane. The upper portion of the middle ear contains considerably more mucous membrane than the lower. We have the anterior and posterior pouches of the drum. We have the chorda tympani nerve, the stapedius and tensor tympani muscles over which is reflected mucous membrane, and the fold of the mucous membrane running from the promontory to the long process of the incus. We have the external and internal spaces of the attic divided by a fold of mucous membrane; the upper incudo-malleolar fold. The outer segment of the attic is again divided into an upper and lower incudo-malleolar space by a fold of mucous membrane running horizontally from the anterior ligament of the malleus to the short process of the incus and attached to the head of the malleus and body of the incus and to the osseous wall of the attic laterally. Then there is the mucous membrane reflected over the external ligament of the malleus, separating this lower space from Prussak's space. This gives a preponderance of mucous membrane in the upper portion of the middle ear and a hyperplasia of this would account for the marked epitympanic involvement seen in these cases. Another noteworthy feature was the flattened superior canal wall, seen first as an obliteration of the inner superior angle of the membrana tympani and canal. Ballenger considers this a sign of

marked suppuration in the border cells of the mastoid and usually a sign for operative interference. Our experience did not bear this out. One case which showed absolute flattening and no signs of an external otitis, revealed at operation a perfectly normal mastoid. Other cases which showed similarly drooping canal walls recovered without operation, this sign persisting to the last. While there may have been a certain degree of mastoiditis which healed, it certainly was not a marked suppuration.

The inner portion of the upper posterior, osseous, external canal contains numerous fine canuliculi. This probably explains the canal wall edema. May not this drooping be simply an extension laterally of the epitympanic process, already mentioned and seen first as an obliteration of the upper angle? The membranous canal is less firmly attached to the osseous in this plane. This may be aggravated by an inflammatory process extending from the epitympanic space and possibly aditus, via the canuliculi. This drooping canal wall was repeatedly seen in cases that otherwise were not clinical pictures of suppurative mastoiditis. External otitis was ruled out in every case. This sign was very persistent, being about the last to disappear and remaining sometimes for about two or three weeks. That this sign was not indicative for operative interference was evident.

X-ray examination of these cases showed cloudiness or obscuring of the cells of varying degree, depending upon the duration of the process. No case showed complete destruction. Operative findings bore these out. Many cases which showed a flattened superior canal wall and a cloudy X-ray picture of the mastoid, cleared up without operation. The lining of the mastoid cells and of the antrum is flattened epithelium continuous through the aditus with that of the tegmen tympani. Presumably a hyperplasia or at least a hyperemia existed here, modified somewhat from that seen in the middle ear. The epithelium cells are cuboidal on the inner side of the membrana tympani and over the promotory and cylindrical on the floor and posterior wall. This would account for the slight clouding of the X-ray picture in the cases in clinically suppurative mastoiditis. Indeed all these probably were cases of mastoiditis but not necessarily suppurative mastoiditis

which we may generally consider as the type requiring operation. The distinction must be kept clear.

The course of this disease at first showed a very acute hyperemia of the middle ear, of sudden onset, with redness, bulging and vesicular formation on the membrana tympani. This soon became a cellulitis, with an acute hyperplasia of the mucous membrane. The same course of events proceeded in varying degree into the mastoid cells, although not evidenced by subjective symptoms, being only shown by the X-ray findings. There was a serosanguinous discharge, redness and swelling of the upper portion of the drum, obliteration of the superior angle of the canal and protrusion of the mucous membrane of the middle ear through openings in the membrana tympani. This was mainly an epitympanic involvement because of the anatomy of the epitympanum. Further extension resulted in the flattening and drooping of the superior and superoposterior canal wall.

The original infecting organism, whatever it was, was not suppurative in its action and pus formation did not occur until we had a secondary infection, following a breaking down in the protective qualities of the mucosa. This was presumably streptococcus. A thin purulent discharge now resulted but the drooping canal wall was independent of this, for this sign was seen in cases which never went on to a purulent discharge.

The picture at this stage was that of a true suppurative otitis media, and one of two things took place. Either this subsided and became convalescent in a varying degree of time or the suppuration extended to the mastoid cells and resulted in a true suppurative (operative) mastoiditis. This was evidenced sometimes by a bogginess of the membrana tympani and slight tenderness and edema over the mastoid, but most constantly by an increase in the amount of the discharge and the thickening of the mastoid periosteum, giving a velvety feeling on gentle palpation, especially upon comparison with the other, presumably normal, side. This stage was reached in from eight to fifteen days.

From this we may conclude that the signs indicative of operation for suppurative mastoiditis following influenzal otitis media are: A history of otitis media with discharge for from eight days to three weeks, often quieting down and then

starting up again; an increased discharge of purulent character; a thickened mastoid periosteum and possibly mastoid tenderness and edema and a boggy membrana tympani. The drooping superior canal wall is not reliable.

Some otologists take the view that every case of suppurative otitis media, going on for over three weeks, should be operated on, if for no other purpose than to preserve hearing. This, of course, is of great importance, but we also must consider the length of time involved before putting men back to duty as effectuals. Some of these cases which ran on for longer than three weeks but which did not show the findings indicative of operation mentioned above, subsided and were discharged as cured from four to six weeks after the onset. Hearing upon discharge was considerably lowered, but prognosis was good for improvement. Subsequent examination, in cases which were possible to follow, showed practically normal hearing in from two to three weeks after discharge from hospital.

In two cases it was possible to remove the tissue protruding through the opening in the membrana tympani and subject it to microscopic examination. The pathologic work was done by Major Robert A. Keilty, M. C., whose reports were as follows:

Case A.—"The tissue is that of a small piece of mucous membrane taken from the middle ear in which the submucosa is the seat of an acute exudate characterized by a diffuse polynuclear infiltration, some fibrin and edematous fluid. There is a hyperplasia of endothelial cells, many from the perivascular lymph spaces of the small capillaries, while the blood vessels are markedly congested. The protoplasm of the epidermal epithelium is granular and shows some structural reduction."

Case B.—"The section is a small piece of mucous membrane taken from the middle ear. The process is primarily an exudative one in the submucosal positions. This is characterized by a diffuse polymorphonuclear leucocyte infiltration and some fibrin with edematous fluid. In addition there is a hyperplasia of endothelial cells arising from the perivascular lymph spaces of the small capillaries. The vessels are congested. The mu-

cosal epiderm shows granularity in its protoplasm, suggesting a reduction in its integrity."

The plan of treatment followed out was early examination of all suspected cases and prompt incision of the drum when indicated. Insertion into the canal of dry gauze wicks which were frequently changed, was employed on all cases in the initial stages and most cases, throughout the course of the disease. A certain number of cases in the later stages were put upon irrigations, but the best results obtained were with the dry wick treatment. It was necessary to carefully clean out the canal and remove any coagulated serum from the incision daily for the first few days, during the course of the serosanguinous discharge.

From this series we have selected five cases as typical and presenting features of interest:

Case 1.—The patient entered the hospital October 2, 1918, aged 23 years; previous occupation, farmer; family history negative; past history, measles, mumps and pneumonia. Complained of general malaise, headache and sore throat. Diagnosis, influenza. Physical examination, negative. Temperature averaged 102 for six days. On the third day he complained of pain in the left ear. Otoscopic examination showed large vesicle on the posterior canal wall, almost obscuring view of the drum, with bleb on the posterior superior quadrant. Incision evacuated serosanguinous discharge. Ran a usual course of suppurative otitis media until the tenth day; the discharge became purulent in character with some edema of the posterior canal wall. Five days later this wall was distinctly flat. There was no mastoid tenderness or edema; hearing 4/20. Two days later, or twenty days after onset, the discharge had almost subsided and the middle ear was almost resolving, but the canal remained flat. Five days later the middle ear was dry, membrana tympani almost normal color, but the canal flat; hearing 4/20. Sent to duty. X-ray plate showed an obscured mastoid.

Case 2.—Admitted to hospital October 12, 1918. Age 21; family history negative; past history, measles, whooping cough, pneumonia, malaria three years previous. Complained of headache, malaise and cough. Diagnosis, influenza. Two days later complained of pain in right ear. Otoscopic examination

showed bulging membrana tympani with vesicles in the anterior and posterior quadrant, extending up to the canal wall. Incision evacuated serosanguinous discharge. Discharge remained serous and slight in amount for eight days, when he again had pain in the ear, and the drum seemed to be bulging. This was incised again. Four days later the drum was again bulging and the superior canal wall was flat. Membrana tympani incised. The next day discharge was purulent, the canal wall flat and membrana tympani red and swollen. Simple mastoid operation was performed, disclosing a normal mastoid. Uneventful convalescence.

Case 3.—Admitted to hospital October 6, 1918. Age 22; previous occupation, laborer. Family history negative. Past history negative. Complained of headache, malaise, pain in the left ear. Physical examination showed few coarse râles in the lungs. Diagnosis, influenza. Otoscopic examination showed vesicles on the canal wall and membrana tympani bulging. Incision evacuated seropurulent discharge. Otitis media improved somewhat and his lungs cleared up. There was slight discharge up to the tenth day, when the membrana tympani was swollen and bulging posteriorly. This was incised again. Two days later the superior canal wall was drooping. The membrana tympani was swollen and bulging. Again incised. The next day the discharge was thin, purulent in character. There was no mastoid tenderness or edema. There was no change in the canal, although the middle ear improved, until seven days later the light reflex could be seen. Soon a titlike process in the posterior quadrant, apparently the hyperplastic mucous membrane, through the incision was seen. There was uneventful convalescence. He was sent to duty November 16, 1918. X-ray showed "left mastoiditis." Hearing on discharge: Left ear, 1/20; upper limit normal; lower limit 1/28; Rinné 6/6. Hearing two weeks later, 20/20.

Case 4.—Admitted to hospital October 9, 1918. Age 30; previous occupation, farmer; family history negative, except that mother died of tuberculosis at age of 65. Past history: Measles, mumps and whooping cough in childhood; suppurative otitis media, right, ten years ago. Following "cold" one year ago became very deaf; treatment was of no benefit. Deafness has not increased in the last few months. Present

history: Had "cold" three weeks previous to admission; sore throat for one day; complained of malaise and headache. Temperature on admission, 100. General physical condition negative.

Otoscopic examination showed on the right some congestion along the margin of the membrana tympani, which was retracted. The short process was unduly prominent and the light reflex distorted. Left ear showed similar condition. Heard only loud conversation with the left ear, nothing with the right. Rinné negative. Galton whistle only heard with the left ear. Diagnosis: Influenza, nerve deafness on the right. Wassermann was negative.

The patient ran the usual course of influenza until on the seventh day, and developed a lobular pneumonia; temperature 104. Medical examination as follows: "Dry râles right, dullness over right back; harsh breathing; mucous râles corresponding to base of lower lobes. Slow increase in whispered voice. Few mucous râles and dry crackles over right posterior axillary region." He complained of no pain in the ears, but on the following day, October 17, 1918, his right ear was discharging quite profusely. This discharge was seropurulent in character. The next day examination showed a small mass resembling granulation tissue at the junction of the superior canal wall and membrana tympani. There was no pus exuding from this. With a probe one could feel denuded bone and a tract leading to the epitympanum. There was little change the next day. This mass was about the size of a small pea and covered the short process. There was some exudate on its anterior portion. There was considerable protrusion of Shrapnell's membrane. October 20th, the patient's temperature was normal and on the following day medical examination showed: "Lungs clearing up, very few râles at right base." October 22d, otoscopic examination showed a moderately thin, purulent discharge, the superior angle of the canal and membrana tympani dissected downward, with the mass previously mentioned apparently hyperplastic mucous membrane. There was a large irregular perforation on the inferior portion of the membrana tympani. No mastoid tenderness or edema. October 23rd, examination showed the lungs to be clear, no râles. The discharge from the ear was increased both in amount and

consistency and was pulsating. There was thickening of the mastoid periosteum. X-ray examination showed: "Right mastoiditis, all cells obscured." Culture from the ear showed both streptococcus and staphylococcus. October 24th, simple mastoid operation was performed, revealing the usual type of influenzal mastoid. Culture taken at operation showed streptococcus. Uneventful convalescence.

Case 5.—The patient was admitted to the hospital October 9, 1918. Age 23 years. Previous occupation, coal miner. Family history, negative. Past history, negative, except for severe contusion of left occipital region from a fall fourteen years ago, following which he was unconscious for an hour. Complains of weakness, malaise and cough. Diagnosis: Influena, lobular pneumonia. October 12th, complained of pain in right ear. Examination showed the drum to be red and bulging with landmarks obliterated. Incised with resulting purulent discharge. October 15th, complained of pain in left ear. Examination showed drum to be red and bulging. Incision evacuated pus. His pulmonary condition greatly improved and he was transferred to the ear department. October 21st, otoscopic examination: Right ear, profuse purulent discharge; the superior canal was slightly flattened; membrana tympani red and swollen; good drainage; no mastoid tenderness or edema. Left ear: profuse mucopurulent discharge; membrana tympani red and swollen; slight periosteal thickening over the mastoid. Irrigations ordered for both ears. November 1st, drainage from the right ear was insufficient and the drum was again incised. Left ear showed no change. X-ray showed slight obscuring of both mastoids. November 2nd, left, simple mastoid operation, disclosing a large diploetic mastoid containing granulations and free pus. Mastoid was exenterated without exposing the sinuses or dura. Temperature had been normal since transfer to the ear department. November 3rd, temperature rose to 102.8; considerable discharge from right ear, the superior canal wall showed marked flattening and there was some thickening of the mastoid periosteum. November 4th, right, simple mastoid operation, disclosing large diploic mastoid containing pus and granulations. There was a small perforation of the tip. Small

in good condition, both wounds clean, very little discharge from middle ears. There was some tenderness and swelling of the neck on the right side. That night his temperature was 100. The next day medical examination showed "lungs not completely cleared up, still a few signs in the right base. Indeterminate râles and increased voice sounds. Temperature 102, no chills, some headache, especially on right side, cerebration slow. Voice somewhat thickened; neck was tender and swollen, especially on right side. No retraction, and stiffness seemed to be accounted for by cellulitis. No spontaneous nystagmus; knee jerks present; no Kernig or ankle clonus. Planters normal. Slight discharge from right middle ear; left dry; both wounds clean. Fundi normal. The temperature that afternoon was 104. Dressing taken down and packing removed from wounds, both of which were clean. Hearing preserved in both ears; medical examination showed "voice sound decreased, axilla and posteriorly, probable fluid or massive pneumonia." Aspirated and no fluid obtained. White count, 23,600. Differential: Polymorphonuclears, 91; small mononuclears, 9. November 7th: Blood culture negative after forty-eight hours. Medical examination showed marked activity in his pulmonary condition. Both mastoid wounds clean and did not seem to be the cause of temperature. Temperature that afternoon, 104.6; some vomiting, not projectile in character. Fundi negative. November 8th: Neurologic examination by Major Coleman, negative except for slight easily exhausted ankle clonus on the right. November 9th, epistaxis similar to that commonly run in influenza. November 10th, patient considerably worse; cloudy sensorium; neck stiff; positive Kernig and ankle clonus. Examination of lungs showed "extensive pulmonary involvement, massive consolidation in left lower lobe." Lumbar puncture; fluid not under increased pressure, but thickened and cloudy. Smear showed streptococci. Fundi negative. Condition precluded any thought of operative interference. Failed rapidly and died November 11th.

Necropsy showed a marked plastic leptomeningitis, undoubtedly extending from erosion of the tegmen antri on the right. There was an obliteration of the left lateral sinus, evidently of some duration, and probably dating back to the old injury

fourteen years ago. Lungs showed extensive lobular pneumonia.

Here our intracranial situation was overshadowed by the marked picture of pulmonary involvement. We were unable to make a definite diagnosis of meningitis until the day before he died.

CONCLUSIONS.

1. In our experiences during the recent epidemic, otitis media was an infrequent complication of influenza and occurred more frequently in cases developing pneumonia.

2. This type of otitis media shows first a hyperemia and then an acute hyperplasia or hyperplastic edema of the mucous membrane of the middle ear.

3. This gives a certain definite and characteristic picture, including a drooping of the canal wall. This last sign is not indicative of a suppurative mastoiditis.

4. The operative signs indicative of suppurative mastoiditis are: Increased purulent discharge and a thickened mastoid periosteum. Mastoid tenderness and edema, if present together with these other signs, are added arguments.

XXVI.

REPORT OF A CASE OF SUPPURATIVE LABYRINTHITIS, AND TUBERCULOMA OF THE CEREBELLO-PONTINE ANGLE, CEREBELLAR ABSCESS, WITH MILIARY TUBERCULOSIS OF THE LUNGS, SPLEEN, KIDNEYS, AND INTESTINES.*

By L. W. Dean, M. D.,

Iowa City.

The patient was a male, white, age twenty-four years, and came under our observation on June 26, 1918.

Briefly the patient's history is as follows: The trouble started four months ago. At that time the patient felt weak and tired. No other trouble was noticeable. A Wassermann examination was made at that time, and a diagnosis of syphilis resulted. Positive history of chancre. The patient received salvarsan without improvement. There was no change in his condition until about five days ago, when walking along the street he began to stagger, and fell to the right. There was no disturbance of the consciousness at that time. At various intervals since, the patient has had a tendency to fall to the right. He has also had a severe occipital headache—worse in the morning. The patient has vomited five or six times—all during the last five weeks. The patient is dizzy much of the time, but his dizziness disappears if he lies on the right ear. For the past month the right arm felt as if it were being pricked with a needle. The patient has lost twenty pounds in the last four months. Four months before, the patient reports that he suddenly lost the hearing in his right ear. No history of earache or aural discharge. The patient's natural mental condition was such that a reliable history could not be obtained.

*Read before the Chicago Laryngological and Otological Society, December 17, 1918.

Examination.—Revealed a chronic otorrhea right; aural discharge, very slight; drumhead completely destroyed; typical rotary labyrinthine nystagmus to the left, also present on looking straight ahead. At times on looking to the right there were typical nystagmoid movements of cerebellar type. The patient always prefers to lie on the right side. There is a papillodema on the right side. The right semicircular canals do not react; the right cochlea is dead. He has headache and vomiting; gait, staggering. The blood examination is negative. The spinal fluid examination is negative. The patient has a partial anesthesia of the fifth nerve. Temperature, negative; pulse, negative; falls to the right, irrespective of position of the head; lungs, apices involved; urine, negative; Wassermann, negative.

X-ray examination: Mastoid blurred.

The patient was too ill for turning tests.

The diagnosis at this time was chronic otorrhea right; suppurative labyrinthitis right with acute involvement of the semicircular canals, the cochlea involved several months before; cerebellar abscess, with the possibility of having neoplasm in place of a cerebellar abscess.

On June 29, 1918, the patient was operated. A chronic suppurative mastoiditis was found. Mastoid cortex eburnated. The necrosis extended to the middle fossa. There was a fistula in the first turn of the cochlea. The promontory was uncapped, and there was no escaped labyrinthine fluid. Pus was present in the cochlea and in the vestibule; there was a pyogenic membrane lining the vestibule. The horizontal semicircular canal was apparently covered with normal base, and it was uncapped—no fluid came from it. By inserting a seeker in the horizontal canal, pus could be forced from it into the vestibule. Necrotic bone extended down to the posterior fossa just anterior to the ascending limb of the lateral sinus. Necrotic bone extended along the posterior surface of the petrous portion of the temporal bone, almost to the internal auditory meatus. The dura was pulsating.

The dura was incised just external to the internal auditory meatus. The cortex was explored. A single small infiltrated mass, subcortical, was found. The floor of the wound bulged markedly. The opinion was expressed that there must be a

deeper abscess or tumor causing the "vis a tergo." The temporosphenoidal lobe was also explored; result negative.

Following the operation, the nystagmoid movements to the right disappeared. The nystagmus of the labyrinthine type to the left was not influenced. The patient was very much better. The vomiting disappeared—also the headache. The opinion was expressed that either the cerebellar disease had been eradicated or the operation was serving as a decompression, thus obviating the manifestations of a deeper lesion. The hernia was much more marked than any we have ever had with small incision and brain abscess.

In the course of several weeks the nystagmus to the left disappeared and it did not return. On the other hand, the nystagmoid movements to the right returned. On dressing the cerebellar wound, pus would escape, then the cerebellar nystagmus would disappear, only to reappear with an accumulation of pus.

On October 10, 1918, about three months following the first operation, a second exploration of the cerebellum was made. The reasons for this second exploration was that during the two weeks preceding it the following findings were made:

(a) Daily temperature of 100 and 101.

(b) Twenty-one cells per c. c. in the spinal fluid on certain days—on others from one to three.

(c) Leucocytosis—13,000.

(d) The mastoid wound had been closed by a plastic; following the covering of the cerebellar hernia the cerebellar symptoms reappeared.

(e) The patient was gradually failing.

At this time the cerebellum on the right side was completely exposed posteriorly and inferiorly. The incision into the cortex was made on the posterior surface. A large abscess cavity with a marked pyogenic wall was found. The floor of the abscess cavity bulged outward, indicating again a deeper pressure. With the finger the floor of the cavity was palpated, and a round smooth cystlike body was found. Owing to a sudden serious collapse of the patient this could not be further investigated. The postmortem revealed that I was palpating a tumor, not a cyst.

Following the operation, the patient's strength gradually decreased, and he died on December 1, 1918.

The postmortem report is as follows:

Tuberculosis of the middle and inner ear. (This diagnosis is based on the macroscopic findings. The temporal bone not yet being decalcified.)

Tuberculoma of the cerebellopontine angle.

Cerebellar abscess.

Tuberculoma of the right auricle.

General miliary tuberculosis of the lungs, spleen, and kidneys.

Tuberculous ulceration of the bowels with perforation.

Tuberculous peritonitis.

Tuberculous adenitis.

The symptomatology of this case, as explained by autopsy and operative findings, is quite in accordance with our conceptions of labyrinthine and cerebellar symptoms, except in one thing: With a labyrinthine nystagmus to the left, and a cerebellar right sided lesion, the patient was always most comfortable lying on the right side.

This is the second case of brain tuberculosis I have had associated with necrosis near the dura. The first case was one of chronic frontal sinus disease with a dehiscence of the inner table, exposing the dura. Frontal abscess was suspected. Exploration of frontal lobe was negative for pus. The postmortem here revealed a tuberculous meningitis.

In the first instance, as in this, the probable diagnosis was brain abscess, and a brain exploration was made, seeking the abscess.

Intracranial lesions with chronic paranasal sinus disease or chronic mastoiditis, we should always keep in mind the possibility of a tuberculous bone lesion and tuberculosis of the brain.

XXVII.

VESTIBULAR ROTATION REACTIONS AND ROUTINE OTOLARYNGOLOGIC EXAMINATION OF 3,748 APPLICANTS FOR THE AVIATION SECTION OF THE SIGNAL CORPS OF THE UNITED STATES ARMY.*

By Austin A. Hayden, M. D.,

Chicago.

This series is reported for a twofold purpose: 1. To give those who expect to do this work some of the more important technical details that have been elaborated and which have enabled us to carefully examine as many as sixty applicants in a single day. 2. To further stimulate interest in the functional tests of the semicircular canals. This field, though old, had never been widely explored until the war created a national demand for the work Jones had fortunately systematized and put to practical use.

It is hoped that a sufficiently large number of cases will soon have been studied by various men, so that the clinical interpretation of the findings can be as clear as a temperature chart or a blood pressure reading.

The Applicants and Their General Attitude.—They have been a lmost without exception the very finest type of red-blooded young American manhood imaginable. The extensive publicity that was accorded the severity of the physical examination apparently kept all but the almost physically perfect away. The percentage of rejections has consequently been very small.

Without exception every man has literally been crazy to fly. Tears have not infrequently been shed when a boy was rejected. The airship seems to be the most immediate means of "getting the Kaiser." For that reason there is no malingering to escape service. Many, on the other hand, have tried to "get by" with disqualifying defects.

*Read before the Chicago Otolaryngological Society, December 17, 1918.

The routine ear, nose and throat examination embraces the following: History of ear, nose and throat trouble, including head injuries and dizziness from all causes;

Examination of
Nose,
Throat,
Nasopharynx,
External auditory canal,
Tympanic membranes,
Cochlea.

Hearing by Whisper,
Watch.

Semicircular canals,

Equilibration by Rotation tests Nystagmus Past pointing
Caloric tests Vertigo Falling

History.—The candidate is most carefully questioned regarding otalgia and otorrhea, tinnitus, head colds and sore throats, head injuries and attacks of seasickness or other vertigo from any cause whatsoever. Among these are mentioned riding on trains, merry-go-rounds, automobiles, horses, elevators, looking from the roofs of high buildings, sitting on swings, hammocks and rocking chairs, or dizziness from looking at any of these things.

Two men presented very interesting histories. They were so dizzy the first (and last) time they rode horseback that they fell from the saddle, one with a fractured skull, the other sustaining an extensive scalp and forehead wound. They showed extreme hypersensibility to turning. Both were, of course, disqualified.

A physician of the author's acquaintance is made so dizzy by looking at a person rocking in a chair that he becomes nauseated.

Another physician whom the author induced to try the chair the first day it came developed nausea, without actual vomiting, that lasted for twelve hours after only five slow rotations had been made.

Examination of the Nose.—Serviceable breathing and clean, healthy noses are required. For that reason ozena, involvement of the sinuses and obstructive deflections of the septum reject the applicant until the condition has been cleared up.

These conditions hold up from 5 to 10 per cent of each day's class.

Throat.—The old mooted question as to what constitutes a normal tonsil came up with almost the first man to be examined. For the practical purpose of this work it was decided to require tonsillectomies of three classes of men: 1. Those who had had recurrent tonsillar infections as often as once a year. 2. Those whose tonsils were obstructive. 3. Those from whose tonsils free pus could be expressed in considerable quantities.

On this basis about 5 per cent of the men have been operated upon.

Nasopharynx.—This is routinely examined with the Michel mirror. So far, no adenoid masses of anything like obstructive proportions have been found.

External Auditory Canal.—Aside from a goodly number of impacted cerumen cases and a few boxers' ears, some of which had been traumatized to such an extent that the canal was barely patent, no pathologic condition has been seen here.

Tympanic Membranes.—Inasmuch as perforations positively exclude from the service, the drums were most carefully examined, and in doubtful cases probed and catheterized for the perforation sound. About one-half per cent have been excluded on this account. One of these cases was of particular interest. The late Dr. William H. Ballenger had performed his mastoid operation on the right ear some five years previously. The hearing was perfect and the drum completely intact. The passage from the external auditory canal back into the antrum could be probed, however, to rather an unusual depth, and Lewy was able to produce the fistula test.

Cochlea.—The hearing is taken by the whisper and by the watch.

Whisper.—The men are lined up and marched single file past the examiner, who collects their papers and places them on his table at one end of the room in their exact order. (Figure 1.) The line stands facing the wall twenty feet away. The clerk stops up the left ear of the last man with his left index finger and then the right with his right index finger. High and low pitched numbers and words are whispered in the usual way. The findings are immediately recorded. Each

man's paper is returned to him as he marches by the examiner again. Full 20/20 for high and low tones is required.

Watch.—A line is formed up and down the center of the room. (Figure 2.) The clerk stands behind the man being examined to stop up first the right and then the left ear, while the examiner stands in front screening the eyes with one hand and manipulating the watch with the other. The results in fractions of forty are immediately noted on the record which each candidate now carries. Forty-forty is considered normal, although a considerably smaller fraction is possible if the whisper showed full 20/20.

Semicircular Canals.—Rotation and caloric tests are used to stimulate the horizontal canal working alone and the vertical canals working together. The reactions manifest themselves in (1) nystagmus, and (2) vertigo.

Nystagmus is a rhythmic to-and-fro movement of the eyes, made up of a slow component, the vestibular pull, and a quick component, the cortical jerk. As the latter is the more noticeable, it designates the direction of the nystagmus, which is always opposite to the endolymph movement.

Spontaneous Nystagmus.—This is looked for first. The candidate fixes on a distant object straight ahead of him. To detect any lateral movements, Jones then turns the chair to the right (Figure 3) and then to the left (Figure 4) until the object is almost out of view. For extreme elevation of the eyes (Figure 5), the examiner's left index finger is fixed upon as he moves it upwards, and for extreme depression (Figure 6) his right, while the lower lids are pulled down in the first instance and the upper are held up against the brow in the second.

Horizontal nystagmus under these circumstances is frequently seen; rotary, occasionally. Jones considers vertical nystagmus pathognomonic of a brain stem lesion.

Induced Nystagmus.—The candidate is seated in the Jones chair (Figure 7), with his head inclined 30° forward, and rotated with his eyes closed, ten times to the right, in exactly twenty seconds. He is now directed to look at a distant object. We use a red water pipe on a building across the street. This is slow turning. As a variation of a few seconds will

cause a marked difference in the duration of the nystagmus, the examiner should always time himself with a stop watch. The duration of the horizontal nystagmus to the left, which is thus produced by the stimulation of the right and left horizontal canals, is noted and recorded. Twenty-five seconds is considered normal. A variation of ten either way is passable. Our own series, however, shows a considerably shorter period to be the average. The candidate is next rotated to the left in the same manner, producing horizontal nystagmus to the right.

Exact Duration.—The duration of the nystagmus is frequently difficult to determine with precision. To do this, the examiner should pull the lower lid away from the eyeball with his right hand, and at very close range continuously watch some particular vessel on the sclera in its relation to a fixed point on the lid margin. The intelligent candidate, for the reason that his own retina is the most sensitive index of his ocular movements, can render valuable assistance, especially when the excursions are small, if he will announce when the water pipe stops moving. This statement must always be verified carefully by the examiner's own observation, as often the inattentive or overanxious will volunteer this information when the nystagmus is still plainly visible. By following these simple precautions the use of convex lenses to relax the accommodation and magnify the movements has not been found necessary.

The nystagmus spoken of in this paper is after-nystagmus of the second degree. No after-after-nystagmus has been seen. Major Norval H. Pierce made the very interesting observation that nystagmus stops with vomiting. In douching etherized patients' ears I have seen the ocular deviation disappear when emesis occurred.

Rest Period, Two Chairs, Nausea.—By allowing an interval of two or three minutes to elapse before making the test for vertigo, the liability to vomiting has been decreased from 16 per cent in the early work of the unit to less than 2 per cent at the present time. This is extremely desirable, as the nausea is often distressingly prolonged. Some men complained of having vomited twenty times and of being nauseated well into the next day.

Two chairs can be used to great advantage (Figure XII). The first man can rest while the second man's nystagmus is being taken. Then the first is ready for the turning for vertigo.

The regulation Jones chairs have been in such great demand that it was necessary to use an older make that had no locking device. This chair can be used with satisfaction, if the examiner will place the heel of his shoe firmly against the footrail, and the ball of his foot on the pedestal of the chair (Figures VIII and XII).

The danger sign of oncoming nausea is a cold, clammy sweat, rapidly followed by intense ashy pallor.

Vertigo.—Vertigo is objectivized as past-pointing and falling.

Past-Pointing.—Here the blindfold is of great assistance and is routinely used, as there is an almost irresistible tendency to look to see where the finger is.

Spontaneous Past-Pointing.—This is always looked for first. The candidate is directed, "Point your right index finger straight out and touch my finger" (Figure VIII). "Raise your arm straight up. Straight back down to touch my finger" (Figure IX). Then the left arm is raised and lowered. Each arm should describe an arc of something less than 90°. To prevent movement of his own finger, the examiner should steady his hand against his body, as shown in Figures VIII and IX.

Induced Past-Pointing.—Position: The head is best inclined 30° forward in the headrest, so that the horizontal canal will be exactly in the horizontal plane. The candidate is told to hold on to the arms of the chair tightly, and to keep his feet on the footstep with heels firmly pressed against the chair. be struck by a flying arm or painfully kicked by the boot of If these precautions are disregarded, the examiner will often a careless applicant.

Starting, Turning and Stopping Chairs.—Rotation is routinely to the right first, and then to the left. The examiner takes hold of the arms of the chair and quickly and forcibly pulls it to the right, continuing the rotation with his other hand on the upright handle (Figure IX).

Ten turns must be made in ten seconds—this is as fast as the chair will go steadily. Until he has turned several hundred, the examiner should be timed by a third person, as the rotation is too rapid to allow him to hold the watch himself.

In the last half of the tenth revolution the chair should be slowed down so that the minimum strain is put upon the foot pedal bar when its lock is released (Figure X). Care in starting and stopping, make adjustments of the chair seldom necessary.

Counting and Recording Past-Pointing.—Immediately when the chair stops locked (Figure XI), the procedure to be followed is the same as described above under "Spontaneous Past-Pointing."

Normally, after rotation to the right, the candidate will bring his finger down to his (the candidate's) right side of the examiner's finger, and to the left, after turning to the left. This is technically known as "past-pointing." It is always in the same direction as the endolymph movement.

For the sake of uniformity, the right arm is pointed and recorded first, the left second, and so on alternately, in this order, until each touches the examiner's finger. The same arm is never pointed twice consecutively. Thus the equation 6 : 1 means that the right arm pointed past the examiner's finger six times, touching it on the seventh attempt. The left arm pointed past the finger only once and touched it the second time, continuing to do so through five more rotations (pointings), till the candidate finally succeeded in bringing his right index finger to touch also.

SOURCES OF ERROR.

1. Past Pointings.—If the arms are raised and lowered rapidly enough, a normal individual can almost, if not completely, suppress his past-pointing. Slow movements, on the other hand, exaggerate it. Each past-pointing should consume about three seconds—one and a half each for elevating and lowering the arm, respectively. Doubtful cases should be done very slowly.

2. Cross-Cutting.—Not going straight up and straight down, waving the hand and groping around in a vain effort to find the finger, must be absolutely prohibited.

3. Preconceived ideas as to just how the pointing should be done cause annoying, time-consuming delays. For that reason the candidates are not allowed to witness the tests before going into the chair themselves (Figure XII).

4. Prolonged turning should be avoided, not merely because of the nausea and vomiting it is likely to produce, but for the further reason that overstimulation of a sensitive end organ, like the semicircular canals, is apt to produce abnormal uncoordinated reactions.

5. Strict silence and rigid discipline aid greatly in doing rapid, accurate work. Under these conditions, and with the help of a well-trained clerk, ten to twelve can be carefully examined in an hour.

The Falling Reaction.—The order, "Knees together—fists upon knees—head down on fists," brings the blindfolded applicant into such a position that his vertical canals are in the horizontal plane, where their endolymph will be set in motion when the chair is revolved (Figure XIII). The use of the forward head-rest is unnecessary.

Rotation to the right, five times in ten seconds (this is slow, being only half as fast as for past-pointing), is timed with the stop watch. The applicant, when told to slowly sit straight up, will veer markedly to the right (Figure XIV). Turning is now made to the left in the same manner.

Occasionally an exaggerated reaction occurs where the body sways far to the right or left, sometimes with violent struggling, to overcome the sensation of falling out of the chair. This stops instantly with the removal of the blindfold.

TOTALS AND AVERAGES.

Nystagmus.—After turning to the right, the 3,748 cases showed an aggregate of 82,231 seconds of nystagmus, representing an average of 21.9 seconds each.

After turning to the left, the aggregate was slightly larger, being 82,373 seconds, or an average of 21.9 seconds each.

Past-Pointings.—After rotation to the right: The right arm past-pointed 7.201 times, giving an average of 1.89. The left arm past-pointed 6.663 times, with an average of 1.77.

After rotation to the left: The right arm past-pointed 8.029

times, making an average of 2.14. The left arm past-pointed 7,083 times, with an average of 1.88.

Of the 3,748 applicants, only 142 were rejected for abnormalities of the kinetic static sense. Of these, 110 failed in past-pointing, 17 in nystagmus, and 7 in falling. Twenty-two men were nauseated and 31 more vomited.

Of the total number examined, 692 were rejected as being unfit to become flyers, while 3,056 were pronounced about 100 per cent physically perfect by the examining unit. The disqualification percentage for all causes was 18.4, or 692 out of 3,748. In addition to the 142 enumerated above, 302 of these failed in the eye examination, 91 in the ear, nose and throat, and 157 in the general physical tests.

In Conclusion.—This report represents an unbelievably large amount of work, and the author wishes to express his sincerely grateful appreciation to all those who have so cheerfully and whole-heartedly helped in its accomplishment, and especially to Dr. Alfred Lewy, who rendered invaluable counsel and assistance at all times.

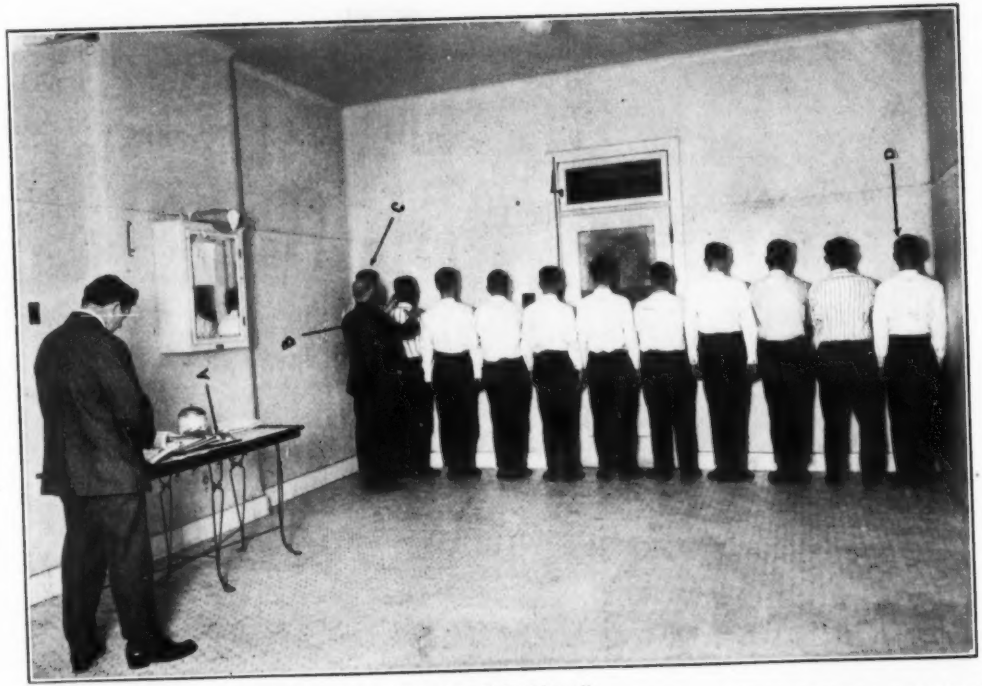


FIGURE 1.—Lined up for the whisper test. "Repeat what I whisper."

A. Pile of records ready to be marked; B. Assistant stopping up the candidate's left ear with his index finger—and then the right; C. The last man to pass by the examiner. His record was consequently on the top of the pile, and his hearing was taken first, but he will be the last of the line as they march back for the examiner to return the papers; D. The first man to hand his paper to the examiner. His record, consequently, was at the bottom of the pile, and his hearing will be taken last, but he will head the line as it marches back for the papers.

This arrangement, as well as that shown in Figure 2, saves much time. A dozen men can easily be carefully examined in this way in less than one half as many minutes.

FIGURE 2.—Lined up for the watch test. "Say 'now' as soon as you can hear the watch tick."
Each man carries his own record, on which the examiner marks the findings as soon as the test is made. A. Clerk, stopping up right ear (in which hearing has already been taken); B. Examiner's hand screening eyes so that patient cannot see where the watch is; C. Watch in position. Examiner manipulates it at various distances and in different positions; sometimes with his hand open, and sometimes closed tightly over the watch, to obtain correct answers to the above command; D. Record spring-clip boards which have been extremely useful.

Strict silence is, of course, maintained during the whispering and watch tests. The men are even cautioned against moving their feet. Both assistant and examiner should work in their shirt sleeves, as the movement of their arms in their coat sleeves makes enough noise to be troublesome.

FIGURE 3.

Rotation of eyes to extreme right to bring out latent spontaneous nystagmus.

The candidate has fixed on the red water pipe a block away, and has been told to look steadily at it. The chair has been turned far to the left, so that his eyes are looking to the extreme right.

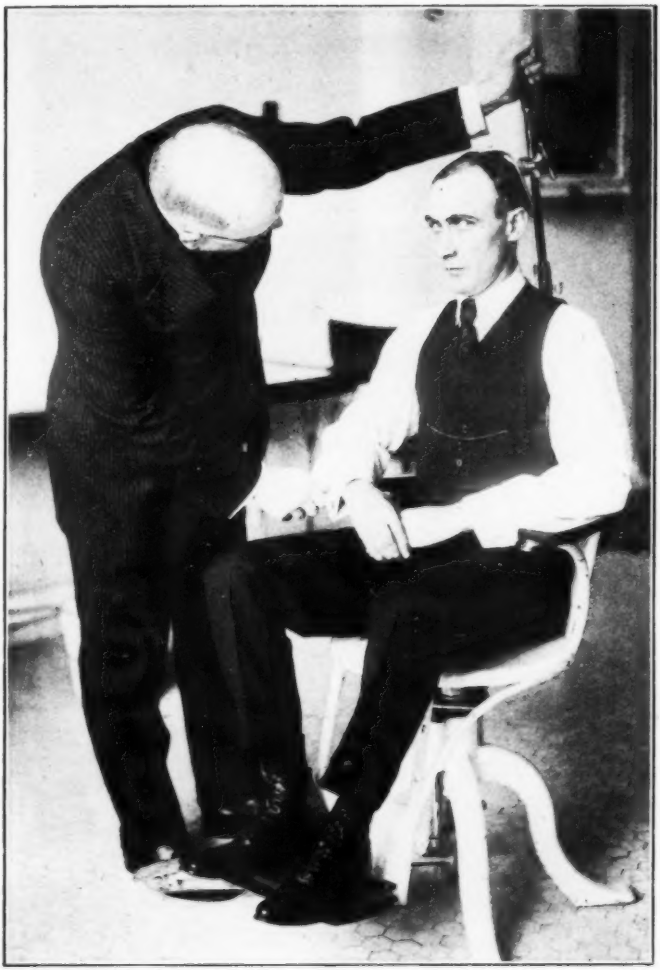


FIGURE 4.
Same as Figure 3, but with eyes rotated to extreme left to bring out latent spontaneous nystagmus.

FIGURE 5.

Extreme elevation of eyes to bring out latent spontaneous nystagmus.

In this position one patient has been seen with a vertical nystagmus upward. Unfortunately, he refused further examination, after having been rejected for service. (Drawing the lower lids down gives the surgeon a much better view of the eyeball.)

FIGURE 6.

Extreme depression of eyes to bring out latent spontaneous nystagmus.

Holding the upper lids against the brow gives the examiner a much better opportunity to observe the ocular movements.

FIGURE 7.

Turning to produce nystagmas, from stimulation of horizontal canals.

Candidate's head 30 degrees forward in headrest; eyes closed; hands grasping arm of chair; feet firmly on footboard with heels pressed tightly back against chair; examiner turning chair steadily by its handle and timing the revolutions (ten times in ten seconds).

FIGURE 8.

Testing for spontaneous past-pointing.

Here the examiner can hold the chair perfectly still with his foot, as its blindfolded occupant is not dizzy and sits perfectly quiet. The same arrangement was used in the old chair (Fig. 12, left chair), which was pressed into service. To hold it still, the examiner simply pressed the heel of his shoe tightly against the footrail, allowing the ball of his foot to protrude through to rest firmly on one of the pedestal's legs. The examiner's right index finger is steadied by his left hand, both pinioned firmly against his body. The candidate's arm is fully extended and stiff. He is ready to raise it straight and bring it straight down back to touch the observer's finger. It will assume the same position, of course, when the past-pointing stops.

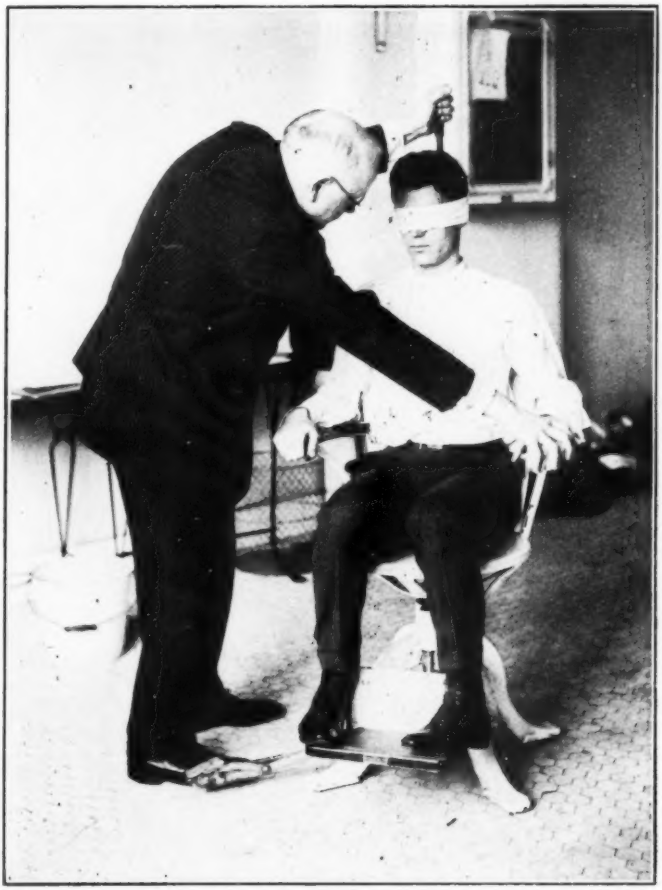


FIGURE 9.

Starting the chair for the fast turning for past-pointing ten times in ten seconds.

Applicant's hands are holding the arms of chair tightly his feet are firmly placed on the footstep, with his heels well back against the chair. The examiner's right hand is starting the rotation by pulling the armrest around so that the upright which he is holding in his left hand and with which the rotation is continued will be saved the heavy strain of starting.

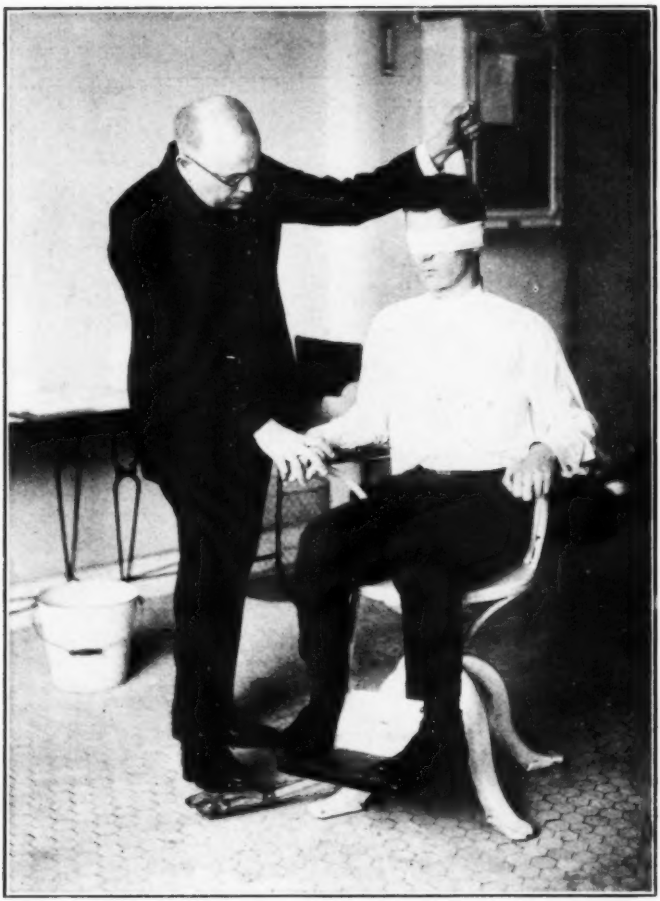


FIGURE 10.

Stopping the chair after the fast-turning for past-pointing.

The last of the tenth revolution is just being completed. The examiner's right foot is pressing down on the inner end of the foot pedal releasing the spring to stop the chair. The outer end of this same pedal, when pressed down, sets the spring so that the chair will revolve. His right hand is stopping the chair to save the foot pedal as much as possible.

FIGURE 11.
Measuring the past pointing.
The chair is locked. The right arm is pointed first, then the left and so on until each touches the examiner's finger.

FIGURE 12.—Arrangement of room to prevent men from forming preconceived ideas as to how they should react to the tests.

Candidates seated on the bench looking away from the chairs out of the window. Examiner and clerk guard against peeking. In the early work they were screened off in one corner of the room. This arrangement soon grew so noisy that finally the present plan was evolved, which has proven entirely satisfactory. The Jones chair is shown to the reader's right, the old chair to the left, with the bucket close at hand for emergencies. The vomiting now occurs in less than 2 per cent of the candidates.

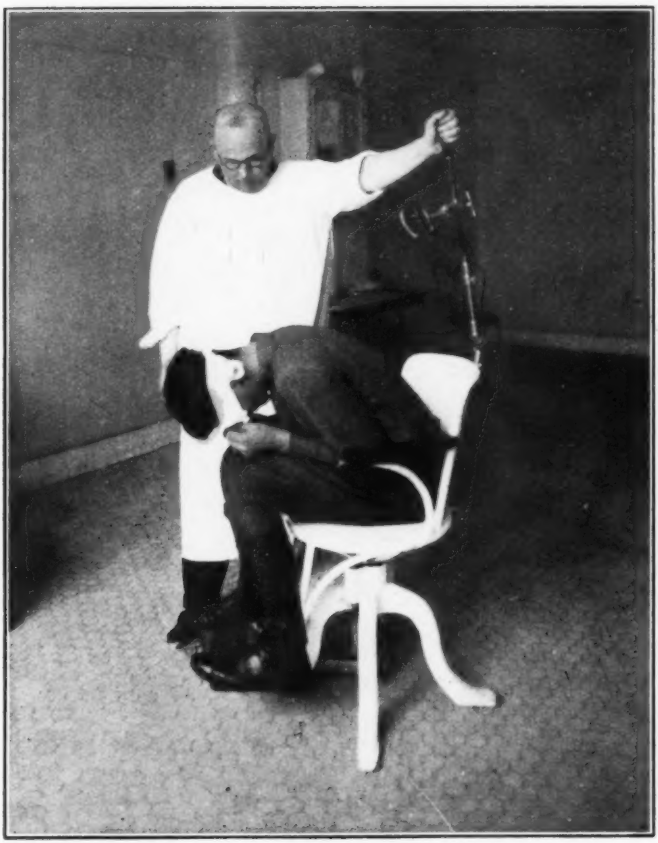


FIGURE 13.
The slow turning (five times in ten seconds) for the falling reaction.

"Knees together, fists on your knees, head down on your fists," brings the man into this position where his vertical canals are level with the floor, so that their endolymphs will set in motion by the turning.

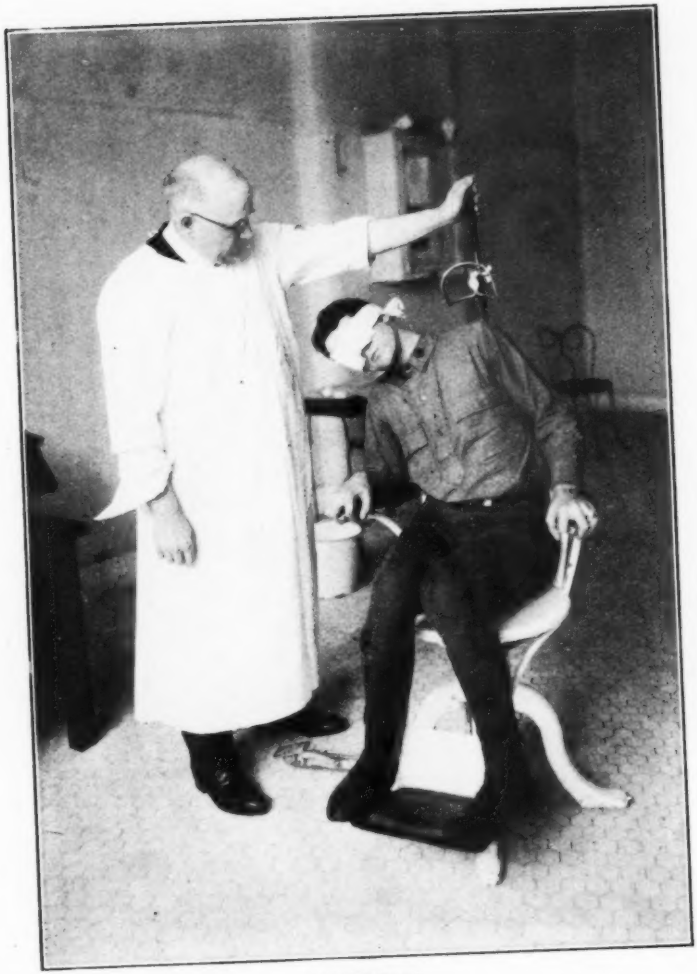


FIGURE 14.
A normal falling reaction after turning to the right.

XXIX.

THE MODERN VELUM OBTURATOR.*

By Calvin S. Case, M. D., D. D. S.,

Chicago.

PRELIMINARY REMARKS.

With the view of showing the difficulties which beset those who are endeavoring to restore the functions of speech to cleft palate patients by surgical and prosthetic methods, and in view of the fact that an intelligent and scientific treatment of this deformity is so largely founded upon a perfect understanding of the mechanism of speech, it might be interesting and possibly instructive to review some of the modern investigations in the physiologic principles of speech under normal conditions; particularly those which have not as yet been published in any of the works upon phonology and orthoepy, because they have arisen purely through needs and efforts of teaching these patients as pupils after operations how to speak perfectly.

As the subject of speech is a large one, with many bypaths leading to interesting fields which one might be led to follow in an extemporaneous talk upon this subject, I have written out the main principles I wish to present which will confine me strictly to the subject in hand.

FUNCTION OF THE VELUM PALATI.

In order to obtain an intelligent comprehension of the scientific principles and practical activities of a modern obturator, in the correction of speech for congenital cleft palate patients, it may be well first to briefly call attention to the indispensable functions of the velum palati, because it is solely through the loss or impairment of this important organ of speech that renders perfect speech impossible with this deformity. There-

*Read before the Chicago Laryngological and Otological Society, February 18, 1919.

fore, anything which is capable of restoring the possibilities of perfect speech to cleft palate patients—whether by surgical or prosthetic methods—must be capable of imitating the action and function of the normal velum.

The first and most indispensable part of the involuntary function of the normal velum is the act of completely closing the oronasal passage in order that the air blasts of speech may be wholly directed and forcibly thrown into and through the oral cavity to be formed into the articulate sounds of speech. This is absolutely necessary for the perfect enunciation of all the oral elements of speech, except those of m, n, and ng—which will be explained later.

The second important part of its function is its light sensitive rapidity of movement, which will be appreciated when we remember that the oronasal passage must be closed and opened at the very beginning and ending of nearly every oral element in a large proportion of spoken words which we distinctly enunciate, and that these words of the English language contain from one to eight oral elements, which when spoken rapidly, require almost lightning like rapidity of movement of the velum.

The third important part of its function pertains to normal voice tone quality and resonance. When we consider that the main resonating chambers of our wonderful speaking instrument lie above the hard and soft palate, we can fully appreciate how necessary it is that the voice vibrations must freely and uninterruptedly enter these chambers in order to produce the required tone and melody of perfect speech.

When the velum palati is stretched out and backward toward the pharyngeal walls in its act of closing the oronasal passage for the enunciation of the consonants, it forms a sensitive, easily vibrated diaphragm, against which the vibratory vowel blasts from the glottis are thrown, and because the vibratory air itself is completely stopped there, it is doubtless thrown into more intense vibrations, and is thus more readily and strongly communicated through the closed velum to the air above, and on to the resonating chambers to be finally moulded into the desired quality and tone of pure resonance; whereas, if this vocalized air were allowed to pass the palate it would result in an unnatural nasality of tone, with diminished reson-

ating quality. This is readily demonstrated by forcibly pronouncing the vocal **ah** with the passage closed, and then with the passage open.

It will be seen, therefore, that in this complete closure of the oronasal passage the natural velum performs two important functions. First, it enables forcibly pressing the air which is the medium of speech, into and through the oral cavity, for the distinct articulation of all the breath sounds of the consonant oral elements, which would not be possible to that perfect extent if any portion of this air were allowed to escape into the nose. In this part of its act, the air is forced against full stops which are the lips and tongue, suddenly opened to emit the explosive oral elements, **ba, ta, da, ga,** etc. Again, it is forced through exceedingly small openings at the tip of the tongue to form the aspirate elements **c, s** and **z,** and through less constricted openings for **sh** in shame, **f** in cuff and fan; **ch** in chart; **Ja** in James, George, etc., and in fact all the forcible breath sounds which give to language its distinct and necessary articulation. Second, this closure, moreover, is quite as necessary for the requisite resonating quality of the vowel elements as it is in the performance of its office for consonants. But for the distinct articulation of the vowels, it is not so necessary that it be completely closed. For this reason we find that nearly all patients with open clefts will quite distinctly articulate all the oral elements of the vowels, but always with a decided nasal tone and with no true resonating quality. This shows that in perfect voice utterances of the vocals, it is quite as necessary that the oronasal passage be completely closed in perfect speech as in the distinct articulations of the consonants.

The only times, therefore, when it is admissible in perfect speech for the oronasal passage to be open is in the utterance of the nasal oral elements, **m, n** and **ng,** which are similar to vocalized humming tones, that are sounded before, after, and between the true vowel and consonant oral elements which demand, as has been shown, a complete closure of the oronasal passage. The vibratory air itself, of which they are composed, is prevented from passing through and out at the mouth, being stopped at the lips for the oral element of **m** (in move), and by the sides and end of a concaved tongue for **n** (in noon),

and between the posterior dorsum of the tongue and velum for **ng** (in going).

It will be seen that in the articulation of these oral elements the vocalized air itself is necessarily forced directly into the upper pharynx, and through the nasal passages, thus acquiring the nasal tone peculiar to these elements in normal speech.

This is no doubt exactly what occurs in the predominating nasality of speech caused by paralysis or any of the diseases which impair or inhibit the functions of the velum palati. It also occurs, to a more or less extent, with healthy tissues, through what I call laziness of the palate, and sometimes to the extent of an acquirement of false sound images, all purely through a lack of determination and appreciation of the importance of distinct articulation with normal voice resonance.

This does not pertain to the nasality of speech which is due to stenosis of the nares, and which produces quite a different quality of tone.

RELATIVE TO TREATMENT.

If what I have given is a true history of the functions of the velum palati, which nature has found absolutely necessary in the production of perfect speech, one can imagine something of the difficulties which confront the oral surgeon who attempts the correction of speech for all cleft palate patients, particularly for those who are far older than infancy.

If a surgical operation can be performed that will restore the requisite normal mobility of velum with its full functioning power to completely close the oronasal passage, perfect acquirement of speech is then possible.

If a complete surgical closure of the cleft is accomplished during infancy in such a manner as to leave a minimum amount of cicatricial tissue in the velum, there is a chance that the soft palatal tissues will grow and develop in proportion to the normal development of the maxilla and adjoining bones, at least up to the time of beginning its speaking function, or at about eighteen months of age.

If this obtains, the patient has arrived at the most important stage in the acquirement of perfect speech, because from that time on through the developing age, the velum palati should

be made to perform its normal speaking function; otherwise it will not take on its full normal developing growth any more than any of the other active muscular tissues of the body when deprived of the possibility of functioning. And after this, if at any time there is an interruption in the speaking function, the time will soon pass for it to possibly catch up and continue with the regular growth of other parts; largely because it will before long be followed by a loss of the true conception of the sound images of speech, when uttered by himself—driven as he is to imitations in order to be understood.

With patients who have had no operations, the bifurcated palatal tissues are usually found quite lacking in normal growth development somewhat in proportion to age.

Of course there is a great difference in the widths of clefts and redundancy of tissue, making a union of the borders of the cleft difficult or easy, but at whatever time after five years of age this kind of surgical union is performed, if upon its completion to a healthy state it is physically impossible for the velum to completely close the oronasal passage so as to commence functioning—which is necessary for its continued growth—the patient is in the same predicament as before.

Again, if more than a mere surgical union of the borders of the cleft is attempted with perhaps a most skillful plastic extension of the velum by utilizing the lateral tissues of the palatal and pharyngeal muscles, the surgical accomplishment is not a velum in the sense that it possesses the possibilities of ever performing the rapid necessary mobile activities of the normal velum, because it is composed so largely of cicatricial tissue. Moreover, it could not properly functionate, except in very rare instances, because however far back the surgical velum is carried, the opening which must necessarily be left for healthy nasal breathing cannot be completely closed by an involuntary action for the necessities of perfect speech, on account of the tense or more or less rigid velum, and this is probably one of the reasons why so many patients who have undergone these operations under the most skillful hands never acquire perfect speech.

Therefore, while the skillful surgical method will often be found to greatly improve or fully correct the articulation, rendering the patient's speech readily understood, even by strang-

ers, the predominating character of his speech will always be of a nasal cleft palate quality.

These same imperfect results must also obtain with all artificial palates and obturators which are incapable of imitating the functions of the velum palati, to say nothing of the thousands of inadequate crass attempts made by dentists who do not possess the first rudimentary knowledge of the requirements of speech.

THE VELUM OBTURATOR.

The modern velum obturator which has developed within the past fifteen years, is an instrument which comes very close to all the scientific requirements of perfect speech, and one which can be depended upon to enable all patients under twenty-five years of age, with typical clefts, to speak with not only perfect articulation, but with normal voice tone quality and resonance, providing the operation is followed by the proper kind of training in phonology and orthoepy.

This obturator is composed of hard black rubber, which will almost float in water, and being reduced to the minimum of thickness, it is almost as light as a feather. It is made to rest evenly and freely upon the floor of the nares and along the upper surfaces of the palatal tissues, completely closing the cleft. Its velum-like pharyngeal portion is as thin as a wafer, except at the borders which receive the firm pressure of the pharyngeal muscles in the active state, in completely closing the passage to the nose; while in the relaxed state of the muscles there is sufficient space for healthy nasal breathing, etc.

The principal reason for its successful activity in the requirements of speech is the fact that it is not attached to any plate or dental fixtures, and therefore is able to freely and quickly respond to the slightest movement of the palatal muscles. Again, when within the grasp of the pharyngeal and palatal muscles in its principal act of closing the oronasal passage, it becomes an admirable transmitter of the voice vibrations to the resonating chambers of the head, thus imitating in every way all the movements and activities of the normal velum.

Furthermore, while it necessarily extends far back in the throat, and being unattached, freely moves with the muscles,

it is worn with perfect unconsciousness of its presence during all waking and sleeping hours, and without the slightest possibility of its becoming dislodged, or of falling into the throat, whatever the position of the head; though it is as easily removed for cleansing purposes as any removable denture.

If you ask, "How is this possible?" I may answer, in the words of the late Dr. John B. Murphy—and in the words, also, I think of hundreds of dentists and physicians who have examined these obturators in action, among whom is your own Dr. Kenyon—i. e., that they must be seen in action in order to be fully appreciated.

The scientific answer is as follows: The nasal extensions which exactly fit the floor of the nares prevent it from falling directly downward, and its oral dome extensions prevent it from being forced upward; nor can it be removed or dislodged except by a backward movement along the line which carries the artificial veil directly toward the posterior pharyngeal wall, but always above the grasp of the swallowing muscles. The moment the muscles sense this movement, so to speak, they contract and drive it back to place in the natural performance of their involuntary function of guarding this portal, even as the epiglottis and eyelids involuntarily guard their portals.

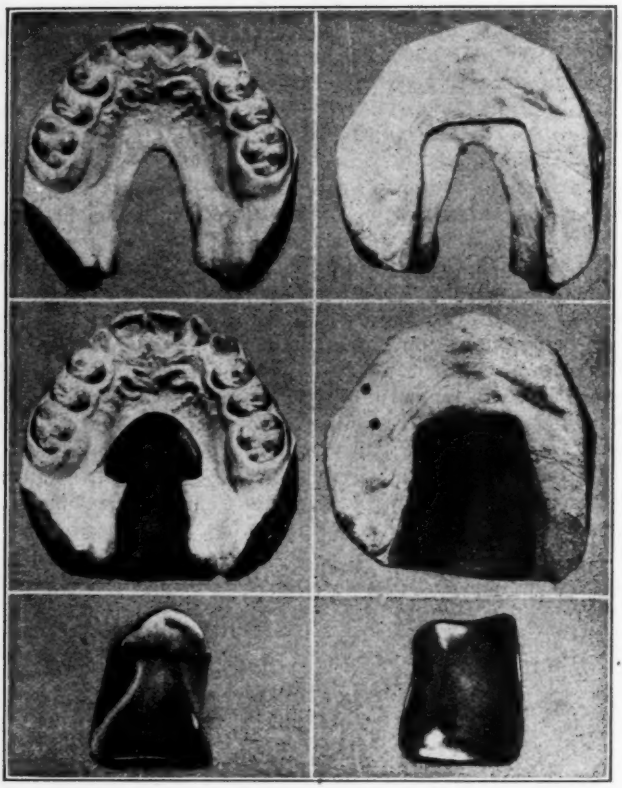


Fig. 1.—THE VELUM OBTURATOR.

On the left is an oral view, first, of a typical cleft; second, the velum obturator in position; third, the velum obturator. On the right are the nasal aspects.

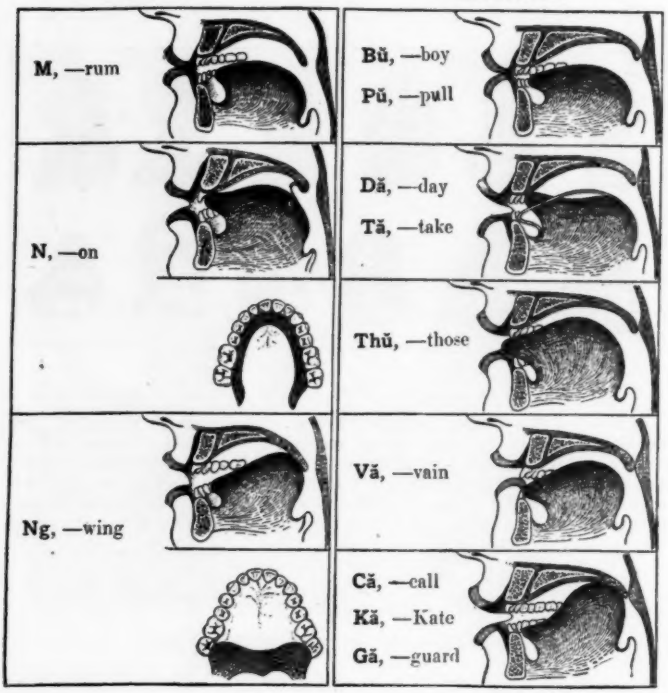
Fig. 2.

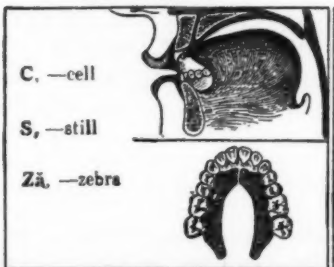
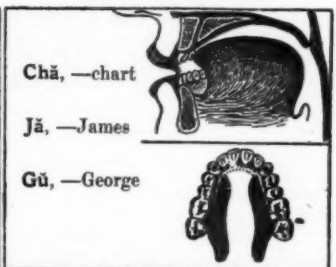
A few of the velum obturators which are now in practical use enabling perfect speech. They are not attached to dental plates or other devices, and are worn with unconsciousness of their presence in the mouth during all waking and sleeping hours, and of which the late Dr. John B. Murphy said, over his personal signature: "Their motion really seems uncanny, it is so natural."

Fig. 3.

PHONOLOGIC CHART

Relative positions of the tongue, lips, teeth and palate, in uttering the four classes of consonant oral elements of speech.



Open Aspirates.	Explosive Aspirates.
C, —cell S, —still Zä, —zebra 	Chă, —chart Jă, —James Gŭ, —George 
Sh, —shame	Lă, —late
L, —still, *similar to* lă R, —bur, " " rŭ	Rŭ, —run Wh, —when
Hă, —hat	Qŭ, —queer Yĕ, —yes
F, —cuff, *similar to* vă	Fă, —fan, *similar to* vă

XXVIII.

THE PROPER PROCEDURE FOR EXTERNAL DRAINAGE OF RETROPHARYNGEAL ABSCESS SECONDARY TO CARIES OF THE VERTEBRÆ.*

By L. W. Dean, M. D.,

Iowa City.

The report of a case of retropharyngeal abscess with injury to the cervical sympathetic after operation by the external route, by Irwin Moore,[1] has influenced me to report the proper procedure for external drainage of retropharyngeal abscess. This procedure was demonstrated to me by Professor Prentiss a number of years ago, and I have proven to my complete satisfaction, both the simplicity and practicability of the operation. The operative procedure is so simple that, in my judgment, not only should every case of retropharyngeal abscess which is secondary to caries of the vertebræ be drained externally, but every case of retropharyngeal abscess should be drained in this way. The operation requires but a very few minutes. There is no reason why this operation should cause shock of any importance, even with a child that is suffering from extreme toxemia. By doing the external drainage, pus discharges externally and not into the respiratory and alimentary tract, where it is liable to do so much damage, especially in children suffering from severe infection. These children are susceptible to pulmonary disease, and evacuation of pus into the respiratory tract, followed by the constant discharge of pus into it, seems to me to be a condition which should be avoided by all means.

The external operation is also indicated because of the fact that the infection of the retropharyngeal space extends in the vertical direction between the fascial planes. It may reach from the basilar process of the skull to the upper part of the

*Read before the Chicago Laryngological and Otological Society, December 17, 1918.

thorax. When we look in the back of a patient's throat we are not always aware of the extent of this vertical extension.

When the external operation is performed, the finger is introduced into the retropharyngeal space, and the extent of the abscess cavity can be easily determined. The drainage tubes can be inserted as high up as the base of the skull or as low down as the clavicle, if such a procedure should be indicated. The drainage which is secured by the external operation, and the proper insertion of drainage tubes, is certainly far superior to that which we get from the stab operation on the posterior wall of the pharynx.

This operation does not contemplate the incision of any muscle except the platysma. No careful dissection is necessary. The operation is simplicity itself and may be performed almost altogether with the index finger. A vertical incision is made in the infrahyoid region along the anterior border of the sternocleidomastoid muscle. The lower end of the incision is opposite the cricoid. This incision should extend through skin, platysma, and vaginal fascia. The sternocleidomastoid is markedly convex towards the median line. This must be considered; otherwise, the operator might incise the muscle. Cutting the vaginal fascia at the medial limit of the muscle permits lateral retraction with ease, exposing the vascular sheath fully. The index finger is inserted into the incision, passed between vascular fascia and visceral fascia. At this point the ala fascia is very loose and can be readily penetrated by the finger. After the finger has passed between the vascular fascia and the visceral fascia, it comes in contact with prevertebral fascia, and is in the retropharyngeal space. The finger may then be flexed, turned in a vertical direction and readily passed up to the basilar process if desired.

The drawings illustrate nicely the anatomic conditions met with in this operation:

First, No. I: We have a drawing showing the muscle fascial planes of a transverse section in the infrahyoid region, at the level of the fifth cervical vertebra. Inside skin and platysma, we find the vaginal fascia. Surrounding the larynx and pharynx, we find visceral fascia. Around the great vessels of the neck is the vascular fascia, which is connected with the visceral fascia by the ala fascia. Then, surrounding the ver-

tebræ and the large muscles attached to them, is the prevertebral fascia and its lateral extension.

A vertical incision is made in the point marked "K." The finger is inserted anteriorly to the margin of the sternocleidomastoid, passes between the fascia of the great vessels of the neck and the visceral fascia, to the point marked "I." The ala fascia is penetrated and the finger is in the retropharyngeal space. As soon as the finger is in the retropharyngeal space, the abscess cavity can be easily felt, be it at this point or higher up. It usually feels like a tense bag. Unfortunately, usually this abscess cavity cannot be penetrated by the finger, and it is necessary to withdraw the finger, retract the wound, and introduce a blunt pair of forceps, hemostat or what-not, and make an opening, or rather a tear in the wall of the abscess cavity; then the finger may be introduced, and the extent of the abscess cavity discovered.

We also have drawings No. II and No. III showing, first, the relation of the muscles after removal of the skin, and second, a drawing with the sternocleidomastoid muscle removed, the vascular fascia retracted, and a guide introduced through an opening in the ala fascia into the retropharyngeal space.

In the report of Irwin Moore, the operation was followed by paralysis of the cervical sympathetic.

As the opening in this operation was made posterior to the sternocleidomastoid, I anticipate that the retropharyngeal space was entered between the vascular fascia and the prevertebral fascia, at a point where there would be most danger of injuring the cervical sympathetic which runs along on the posterior surface of the vascular fascia.

In the discussion of Mr. Moore's paper, the statement was made that when there is great swelling of the neck, in opening retropharyngeal abscess, the landmarks being obliterated, there was danger of exposing the anterior border of the sternomastoid instead of the posterior, which would make the opening of the abscess very difficult. This is a statement not borne out by fact.

The statement is also sometimes made that in opening a retropharyngeal abscess it is necessary to dissect through the pharyngeal muscle; this is not necessary. The impression is frequently given that this drainage is a very difficult thing to

do. I am positive that trying this procedure once on a cadaver will convince anyone that this is not only the proper procedure for the drainage of retropharyngeal abscess, but it is simplicity itself. I am also under the impression that such a procedure is so simple that the evacuation of pus from the retropharyngeal abscess by the stab operation on the posterior wall of the pharynx will not be performed in any case; rather, an external drainage, with the proper insertion of drainage tubes, will be the procedure of choice.

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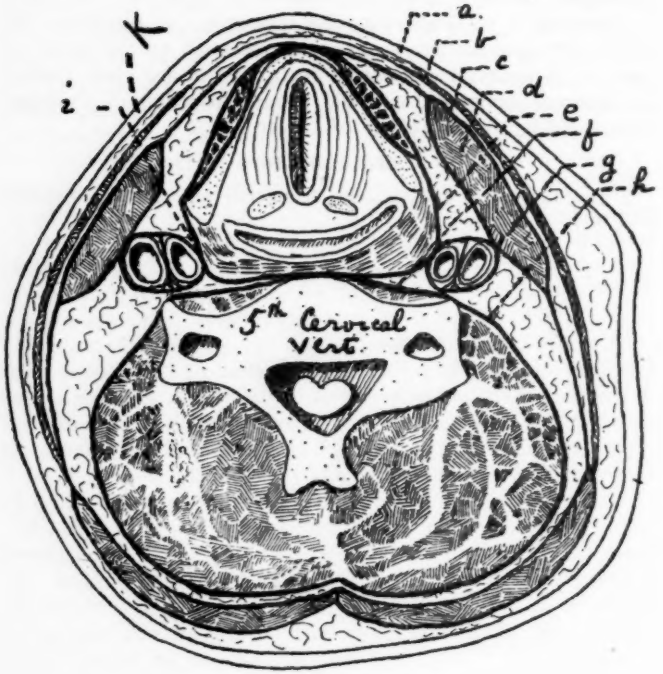

FIGURE 1.

a — Skin. b — Platysma. c — Vaginal fascia. d — Sternocleidomastoid. e—Visceral fascia. f—Prevertebral fascia. g—Vascular sheath. h—Lateral extension of prevertebral fascia. i—Ala fascia.

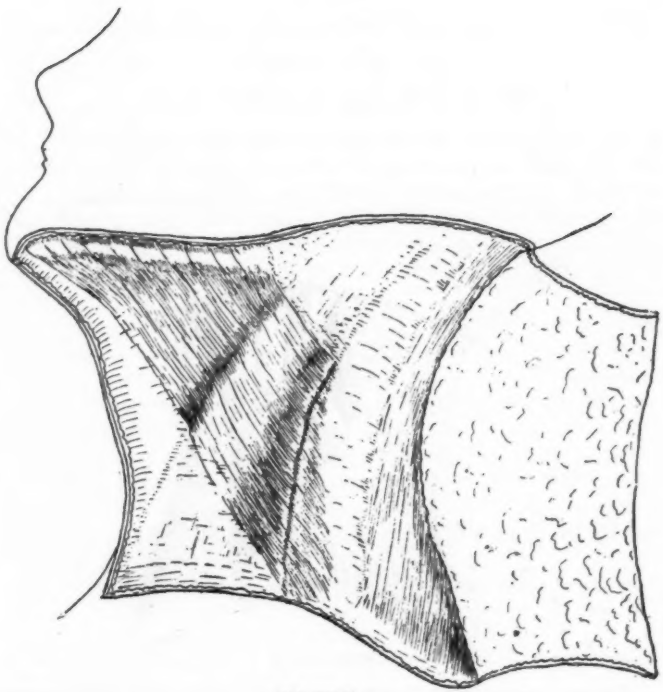

FIGURE 2.

Skin and superficial layer of superficial fascia reflected. Platysma, in deep layer of superficial fascia, fusing with vaginal fascia over posterior triangle.

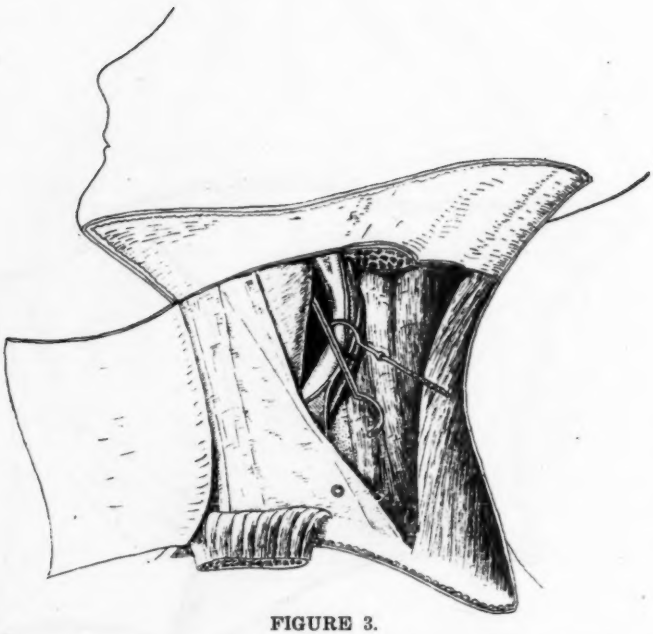

FIGURE 3.

Vaginal fascia below hyoid bone reflected exposing neutral zone, between hyoid bone and cricoid cartilage. Muscle compartment crossing vascular sheath at level of cricoid cartilage.

ABSTRACTS FROM CURRENT LITERATURE.

I.—EAB.

The Cephalorachidian Fluid in Otitic Endocranial Complications.

BORRIES, G. V. TH.

Acta Otolaryngologica, 1918—I—86.

With cerebral symptoms accompanying an acute or chronic otitis media, if lumbar puncture gives issue to clear fluid this is generally regarded as excluding diffuse purulent leptomeningitis. If the fluid is turbid, showing abundant polynuclears and even microbes, it is regarded as one of the strongest signs of leptomeningitis, and if the fluid clears progressively recovery may be expected.

However, the author has collected and seen cases in which the fluid was clear from the beginning, or, if clouded early, cleared later on, and yet the patient died. He believes that in such instances the meningitis is not due directly to the otitis but comes from an intermediary complication such as cerebral or subdural abscess (possibly also encephalitis, sinus phlebitis, extradural abscess, etc.). In some of these cases only a cerebral or subdural abscess was found without any apparent meningitis, although the latter might possibly have been found by microscopic examination.

A practical application of these facts is that, with clear spinal fluid and progressing meningeal symptoms, cerebral or subdural abscess should be suspected.

The author relates a case in point. A. Miller.

Mastoidectomies Under Local Anesthesia. A Brief Report on Nine Mastoidectomies (One Double), Under Local Anesthesia, at the Base Hospital, Camp Upton, New York.

PORTER, C. T.

J. Am. M. Ass., Chicago, 1919—LXII—546.

The method of administration was as follows: The patient was first given one-fourth grain of morphin subcutaneously, and in half an hour a 0.5 per cent solution of cocain or pro-

cain, when the latter became available, was injected into the skin along the line of incision. The injection was then carried into the deeper layers and finally under the periosteum over the entire area of the mastoid. The insertion of the sternomastoid muscle and the posterior canal wall were injected at the last. About 15 c. c. of a 0.5 per cent solution were used, in each case, although as high as 30 c. c. of a procain solution were used in one case—a double mastoiditis—and as low as 6 c. c. of a 0.5 per cent solution of cocain were used in another case.

After waiting for from five to ten minutes, the operation was started and carried on in the usual manner. The patient usually complained somewhat of the pounding necessary to remove the cortex, but all admitted afterward that there was little actual pain.

In only one case was it necessary to resort to general anesthesia. In this case, that of a Russian who was very nervous and apprehensive from the start, we finished under chloroform.

One case in which a double mastoidectomy was done at the same time deserves special mention, as the patient was so ill at the time that it was not deemed advisable to give any type of general anesthetic.

The most remarkable thing about these cases was the almost total absence of any shock following the operation.

Emil Mayer.

Study of Etiologic Factors Bearing on the Therapeutics of Bell's Facial Palsy, Based on a Review of One Hundred and Seventy-seven Cases.

LEINER, JOSHUA H.

Med. Rec., N. Y., 1919—XCV—319.

Bell's facial palsy occurs comparatively more often on the right side; this is shown both anatomically and clinically.

It occurs twice as many times in the female as in the male.

It occurs more often between the months of April and September, inclusive.

Because of the last mentioned fact, the primary etiologic cause is exposure, and this factor also enters in those cases occurring during the winter months.

Counter irritation should be the earliest, and proves the most efficacious remedy if the case is a primary facial palsy.

All electricity should be immediately stopped when the first symptoms of contracture appear.

Electricity (galvanism) is the only treatment in chronic cases, and should be employed even up to a year after the onset of the paralysis, providing there is no tonic contracture of the musculature. The writer has seen cases that have gotten better after a full year's treatment. Emil Mayer.

A Case of Labyrinthal Meningitis, With Suggestions for a New Labyrinth Operation.

KAHN, ALFRED.

Med. Rec., N. Y., 1918—XCIV—930.

The writer attributes the recovery in this case to the fact that the diseased area involved the inner wall of the middle ear, that this wall was soft and necrotic, and that it was further accidentally injured at the time of the radical operation in an anxious endeavor to remove all necrosed bone; that it was through this passage, by way of the internal auditory meatus, that the labyrinth was destroyed and that meningitis took place. It is for this reason that the radical cavity granulated almost up to the surface, and that the radical cavity itself became entirely obliterated. With the experience of this case in mind, and with its evident recovery due to a direct drainage from the meninges through the internal auditory meatus, through the internal ear, middle ear., etc., through an accidentally artificially created opening, the possibilities of a new labyrinth operation have made themselves apparent.

The object of the operation is to drain as wide an area of the meninges as possible. The meninges must be exposed over a large surface; the opening leading into the meninges must be large and the drainage directly out into the radical cavity, where the wound can easily be handled—not through a small opening, but through a large opening directly under the eye.

Technic of the Operation.—First, performance of the radical operation.

Second—The radical operation must be carried to its furthest

limits; the facial ridge must be cut down to its very last shaving; the middle ear must be curetted till the bone surrounding it is extremely thin; in other words, the middle ear cavity must be enlarged as much as possible. The sinus should be exposed from above the knee, and exposed and followed downward toward the bulb as deep as possible. The bone in front of the sinus must be cut away as deep as possible, exposing the soft parts beyond; the dura outlining the middle cranial fossa above the middle ear should be exposed as deeply and as far forward as possible; in fact, the dura should be exposed over such an area that it will form a junction with the dura covering the sinus region, and the exposure should extend as far forward as the superior semicircular canal. The dura outlining the middle and posterior fossæ and covering the sinus should be exposed; the horizontal and external semicircular canals, and, if possible, the superior semicircular canal should all be brought into view.

Third.—The promontory is now opened, and a direct passage is made through it, so that the internal auditory meatus communicates through a direct passage with the middle ear. The modiolus and whole internal ear should be broken down, and this communicating path between the internal auditory meatus and the middle ear should be made as large as possible. When the modiolus is broken down, and the internal auditory meatus opened, there will be an escape of cerebrospinal fluid; the passage must then be packed tightly, as we enter upon the final stage of the operation.

Fourth and final stage.—The bridge of bone now remaining between Trautman's triangle posteriorly, and the middle ear, which holds the facial nerve and the horizontal, external, and superior semicircular canals, should be broken down and absolutely destroyed; you have now exposed a large area of dura and have converted the anterior and posterior portions of the radical cavity into one large cavity. In other words, the brain is exposed over an area extending from the carotid artery in front to beyond the sinus behind, and the area of dura in the region of the internal auditory meatus has a straight passage for draining to the outside.

This operation is indicated only as a last extreme measure to save life where death is practically certain; under the cir-

cumstances, the facial nerve should be sacrificed. The other objection might arise that opening of the modiolus causes a loss of cerebrospinal fluid; and that by opening the internal auditory meatus you open a direct pathway for infection to the meninges; but in this connection it must be remembered that the meninges are already infected, and that if infection cannot enter it also cannot escape. The destruction of the promontory and wide opening of the internal auditory meatus make possible drainage of this area of infection. This is a fact that cannot be denied.

It is of greatest importance that this radical labyrinth cavity be finally packed and drained by means of gauze, for when gauze is used the tissues have something substantial around which to build and to demarcate the infection. A large quantity of infectious material is thus absorbed very quickly.

Emil Mayer.

Hearing and Its Regulation, Especially in Middle Age and Early Senescence.

TAYLOR, J. MADISON.

Med. Rec., N. Y., 1919—XCV—56.

The possibilities of improving states of neglected or impaired audition will be noted as encouraging. They consist in emphasizing attention and self-regulation of the patient to his function of hearing; in learning the direction and degree of underdevelopment, both in structure and function, or a combination of structural and functional neglect, inattention, and apathy, and improving the conditions.

The chief objectives are (1) to achieve conscious control over all parts concerned in hearing, direct and associated, i. e., in training of voluntary and semivoluntary structures, and (2) to direct intelligent attention, critical and helpful, to elaboration, cultivation, and refinement of the function of audition, to bring up to par all the latent powers which reside in the aural equipment as a whole.

Procedures: 1. Passive motions, manipulations applied to the structures; seize the concha with the encircled fingers, draw it up and down, backward and forward, round and round; in applying manipulation to the neck, the posterior

scalp—which is usually found rigid and adherent, also to the dermal structures over the second, third and fourth thoracic vertebræ (vasomotor subcenters), by pressure and relaxation, by lifting and pulling the overlying skin, and also by mobilizations of the joints of these vertebræ at corresponding levels by alternating pressures.

2. Making active movements of the jaws, opening widely as possible, rotating, side to side, forward and back; also in yawning and swallowing afterwards.

3. Active movements of the neck, to the right, to left, also thrusting the chin forward each time, then chin up vertically, forward and back.

4. Inducing the patient to seize the back of his head with hands clasped and to bend far forward and down, then to push the hands back with the head (neck muscles) and repeat five or six times with increasing force.

The whole procedures occupy about six or eight minutes and should be repeated at least once, preferably three times daily. Emil Mayer.

Blood Clot Dressing in Mastoidectomy. Modified Technic Which Assures Primary Painless Healing Without Deformity. Preliminary Report.

DAVIS, GEORGE E.

J. Am. M. Ass., Chicago, 1919—LXXII—169.

The writer emphasizes the importance of thoroughly drying the granulation surface before applying strong silver solutions. This little point in technic prevents pain and reaction, as moisture is essential to conduction of sensation unless undue pressure is made.

The support furnished by the blood clot before it disintegrates prevents sagging and deformity of the postauricular wound; and as healing is primary, no long, painful packing after-treatment must be endured to wreck the patient's nerves, body and purse.

The advantages of the modified technic of the blood clot dressing are:

2. The completion and maintenance of this sterility by the iodoform gauze packing of the wound for twenty-four hours, which prevents the infection from the deeper tissues that may occur from the operative reaction drainage when the clot is inducted at the time of the operation.

3. Its simplicity and effectiveness which enables the average surgeon to use it successfully in or out of hospitals.

Emil Mayer.

A Case of Acute Mastoiditis With Perisinus Abscess, Following Influenza Pneumonia; Operation Performed Under Novocain and Morphin Anesthesia.

SHEEHAN, JOSEPH EASTMAN.

Med. Rec., N. Y., 1919—XCV—323.

The mastoid operation can be performed with entire satisfaction under local anesthesia, provided the skin, periosteum, aditus and membrane of the middle ear are properly anesthetized.

The bone has no sensation.

Injury to the facial nerve is immediately noticed.

There is practically no after-effect.

Local anesthesia should be employed in all cases where the administration of ether or chloroform would be an added danger.

Emil Mayer.

II.—NOSE.

Treatment of Blocked Nasal Ducts From the Rhinologic Standpoint, With Special Reference to Toti's Method.

FISCHER.

Zeit. f. Augenh., Berlin, 1918—XXXIX—1.

The writer has so far performed Toti's operation in twenty-three cases, and his results have convinced him that this procedure deserves more consideration than it has yet received.

The principle of Toti's operation is the removal of the nasal wall of the tear sac through a skin incision, and corresponding to this opening to make a window through the bony wall into the nasal cavity, through which the tears can flow into the nose.

The author much prefers local anesthesia, using for infiltration novocain 0.5, suprarenin 0.002, sodium chlorid 0.6, in water 50.0. With this, particular attention is paid to getting the solution well under the periosteum in several places. Of course, with young children and very restless persons general anesthesia is required.

It is quite important for the success of this operation that the puncta and canaliculi be in a normal condition, neither blocked by fibrous tissue nor slit. In three of the twenty-three cases on which the author performed Toti's operation both canaliculi had been slit and the desired result was not obtained.

In seventeen of the remaining twenty cases there was, after the operation, a good working passage into the nose; the other three allowed the easy passage of a sound but not free passage of liquids. The greater number of these cases being soldiers, it was impossible to follow up later conditions in but a few instances; seven in varying periods from five to thirteen months continued to have very good function in the passage of tears on the operated side.

Although the pus secreting mucous membrane of the sac is left in place and not excised as in an extirpation of the tear sac, yet after Toti's operation the purulent discharge drains downwards into the nose and leaves the eyeball out of danger.

In seventeen of the twenty-three cases reported, the author from rhinologic examination is of the opinion that the condition of the nose, particularly ethmoid disease, was the primary cause of the blocking of the nasal duct. This proportion agrees with the findings of Kuhnt, Brunzlo, Rhese and Shuster, but differs from those of West who, in over 480 cases of tear sac disease, found nasal involvement only in rare instances. However, the author thinks that in a blocking of the nasal duct due to trouble in the nose it is not sufficient simply to remove the nasal disease to restore the passage of tears.

The only objection to Toti's operation is the resulting scar in the skin. Against this is the statement of West that in his intranasal operation (practically the same as Toti's operation, only making the opening into the tear sac from the nasal side) is contraindicated in little children, elderly people and where

there is a closure of the nasal passage by fibrous tissue. Also submucous resection must sometimes precede this intranasal operation.

Maxillary Sinusitis.

PONTOPPIDAN, FR.

Acta Otolaryngologica, 1918—I—74.

Statistics of 175 cases of maxillary sinusitis which Pontoppidan has treated are summarized. The ages by decades were as follows:

10 to 19 years	31 cases
20 to 29 years	55 cases
30 to 39 years	49 cases
40 to 49 years	17 cases
50 to 59 years	14 cases
60 to 69 years	4 cases
70 to 79 years	3 cases

The cases were about equal in number as to sex. The left maxillary sinus was most often affected. In forty-four cases (25 per cent) the sinusitis was double. As to etiology, in four cases only was the trouble of dental origin; usually there was a history of a cold or influenza; in three cases there was a trauma, three were malignant, two syphilitic and one fibrous polyp. (In numerous cases of extensive internal lupus of the nose he never saw a single instance where maxillary sinusitis resulted.) Duration varied from two days to ten years. Forty per cent had headache, frontal or above the eyes or at the root of the nose, sometimes violent but usually not acute. In only 9 per cent was pain in the jaw or antrum complained of. Three cases had a typical infraorbital neuralgia. Fifty-three per cent had nasal symptoms; usually obstruction, either unilateral, bilateral or alternating. Occasional symptoms were coryza, sneezing and kakosmia. Ten per cent had ear symptoms ranging from acute otalgia to tinnitus. Twenty per cent had general symptoms—malaise, fatigue, etc. As to the eyes, there were a few asthenopics, but no inflammations, such as occur in affections of the ethmoid or sphenoid cells.

As to diagnosis, diaphanoscopy was positive in 142 of the 152 cases; the other ten were negative, though pus was present in the sinus. Some cases had obscuration without any definite pathology, due possibly to mucosal thickening from a healed empyema. Radiography, he thinks, is rather superfluous. For aspiration and lavage he prefers to puncture through the inferior meatus. Nineteen cases were complicated with frontal sinusitis, fourteen with ethmoiditis, and three had a pansinusitis. Three cases of maxillary cyst were met.

Aspiration alone sufficed for a cure in five cases. In forty-four cases (25 per cent) puncture and lavage (one to fifteen times) effected a cure. If, after four lavages, no amelioration was noted, operation was done, usually the Luc-Caldwell. Since 1912 he has employed local anesthesia only; cocainization of the nasal mucosa, and injection of novocain-adrenalin into the canine fossa and infraorbital nerve. In the Luc-Caldwell operation he contents himself with removing the wall of the inferior meatus together with a small portion of the anterior end of the inferior turbinate. All pathologic mucosa in the sinus is removed. A. Miller.

Asthma From the Point of View of the Rhinologist.

BROWN, R. GRAHAM.

Med. J. Australia, Sydney, December, 1918.

Asthma has a neuropathic basis and various exciting causes. For successful treatment a correct grouping is necessary. It is useless to treat cases due to intrathoracic causes by intranasal methods. Where the symptom is due to intranasal pressure, this must be relieved; a mere change of climate is inadequate. The grouping is set out in the paper. Subgroup No. 2 describes cases where with hypersensitive nasal mucous membrane and deformities giving rise to intranasal pressure good results follow intranasal treatment. Brown speaks highly of the method of Francis, "which is entirely his own." He regrets that many "who profess to follow Francis have not the slightest idea of his "streak" cauterization! Abstractor, while not convinced that Francis has evolved any mystery method for the successful treatment of asthma by intranasal methods, will give his follower Brown's account of the same: "Francis

produces as little destruction as possible [cautery]. He is guided in his treatment by its effect on the blood pressure.

1. Blood pressure, 155 m. m., outlook excellent. 2. Blood pressure, 130-155, not so good. 3. Blood pressure below 130 m. m., seldom improved by cauterization." Robertson and Brown of Brisbane support this theory. A. J. Brady.

III.—PHARINX AND MOUTH.

Anterior Dislocation of Atlas Following Tonsillectomy.

SWANBERG, HAROLD.

J. Am. M. Ass., Chicago, 1919—LXII—107.

A private, white, aged twenty-two years, a farmer before entering the army, with negative family and past history, was admitted to one of the base hospitals December 19, 1917, suffering from measles and acute follicular tonsillitis. Tonsillectomy was performed January 16, 1918; the night of the operation the patient's neck suddenly became stiff, and had remained that way ever since.

July, 1918: On arrival of the patient at this hospital, the general condition was good; the weight was normal; the neck was stiff, all motions being resisted in every direction; the soldier held his head in a rigid position with the chin depressed; he complained of pain in the cervical muscles on motion attempted in any direction; he could not rotate his head; he had persistent headaches. The general physical examination was negative except for exaggerated knee reflexes.

The X-ray findings were very positive. There was a simple, complete, anterior dislocation of the atlas and skull on the axis (epistropheus), unaccompanied by fracture. Stereoscopic plates showed the odontoid process (dens) free from any bony articulation and intact, the remaining part of the cervical spine being negative. The lateral masses of the atlas were no longer in contact with the superior articular processes of the axis. As the spinal cord must necessarily pass between the odontoid process of the axis and the anterior margin of the posterior arch of the atlas, it seems unreasonable to believe that it would be free from pressure in that small space in a complete anterior dislocation of the atlas, yet the patient had no symptoms

of cord pressure. It appears quite evident that the transverse ligament of the atlas (the ligament that holds the odontoid process in contact with the anterior arch of the atlas) was ruptured, for it is hardly reasonable to suppose that the odontoid had slipped from under it. No evidence of osteoarthritis was seen in any of the cervical vertebrae. Following the roentgen examination, the nasopharynx was palpated, and the anterior part of the atlas was very easily felt as a large, rounded, bony mass pressing forward and occupying a large part of the cavity.

The soldier was placed under ether anesthesia and manipulation attempted. A gain from 5 to 100 degrees in rotation was noted, and flexion, extension and lateral bending were practically normal. Following the anesthetic the neck appeared more stiff than before, roentgen reexamination showing no change in the position of the parts. The soldier declined further manipulation or operation. Suspension of the entire body from the head was of no avail. Emil Mayer.

Neurotic Mucosal Ulcer of the Mouth (Ulcus Neuroticum Mucosæ Oris. Ulcus Apthosum Chronicum).

STRANDBERG, J.

Acta Otolaryngologica, 1918—I—103.

This rare disease seems to have been described first by Jacobi, Sibley, Kirk and Court. Later on Löblowitz noted it in Germany. Strandberg described two cases in 1911, the disease being until then unknown in Sweden. Recently he has encountered nine more cases, chiefly members of two families. Case histories of these are given, and seven other cases in the literature are tabulated.

The mucous membrane anywhere may be affected—mouth, fauces, pharynx and larynx, rarely the conjunctiva and genitalia (Sibley). The process begins as a red granulation, the size of a pinhead, growing to the size of a pea in one or two days, necrosing in its central portion where it is yellowish in color. It then becomes a grayish yellow ulcer with red borders and an infiltrated zone of reaction, and varies in size up to a diameter of 5 c. m. The ulcers are round, elongated or polycyclical. They heal spontaneously but may last for

two months, and recur at intervals two or three times yearly, though in severe cases one attack rapidly succeeds another.

Pain is a marked feature, often described as terrible and out of proportion to the size of the lesion, causing severe dysphagia. Salivation is a feature. As a rule there are no constitutional symptoms, adenitis or fetor ex ore. Ages of patients varied from 4 to 74 years. Females predominate.

Histologic examination found only the picture of an ordinary inflammatory process, with destruction of epithelium.

Bacteriologically, solitary staphylococci are found most often and occasionally spirochetæ of Vincent (secondarily?). The lesions in healing leave a scar which later also disappears.

Treatment of every sort, including radium, seems to be without effect. A. Miller.

IV.—LARYNX, TRACEA AND ESOPHAGUS.

New Laryngeal Speculum.

BENJAMINS, C. E.

Acta Otolaryngologica, 1918—I—50.

For several years Benjamins has sought for a simple method of direct laryngoscopy by which the anterior portion of the larynx could be seen satisfactorily. He believes he has found this in his new speculum. It consists of a troughlike arm attached at a right angle to a handle. After local anesthesia of the larynx the patient is seated on a high stool with his head bent to the left. The speculum is introduced at the right commissure of the mouth and along the right side of the tongue. The larynx is viewed somewhat obliquely, and its left side is seen slightly better than the right, but the procedure can be reversed, of course, if desired. A. Miller.

Foreign Body in the Esophagus with Impending Perforation Into the Trachea.

HOLMGREN, G.

Acta Otolaryngologica, 1918—I—93.

A man aged thirty years, during a meal complained that a piece of meat had stuck in his throat. He went to a hospital where a probang was used, and, according to description, a

piece of meat extracted. However, his troubles increased, and five days later he came to Sabbatsberg Hospital, complaining of dysphagia, constant severe backache and cough with some bloody expectoration. By indirect laryngoscopy (Killian) the posterior wall of the trachea somewhat below the larynx was found to be read and swollen and bulged into the lumen of the trachea, the protuberance ending in a rather pointed tip.

After cocainization the bronchoscope was introduced to a depth of 20 c. m., and a dirty gray fixed foreign body was found, which had perforated the esophagus anteriorly. On extraction the foreign body proved to be bone. Recovery was practically immediate.

The case is presented as showing the disadvantages of the probang (which in this case may have driven the bone through the esophageal wall) and the very considerable advantages of the esophagoscope.

V.—MISCELLANEOUS.

Contribution to the Pathology of Tuberculosis of the Bronchial Glands.

SCHMIEGELOW, E.

Acta Otolaryngologica, 1918—I—1.

The author has chosen this subject for two reasons: First, because the matter has not been thoroughly discussed in Scandinavian literature; second, the application of direct bronchoscopy has given a new source of information concerning the condition.

In March, 1902, Scholdemose reported to the Danish Medical Society a case of tuberculosis of the bronchial glands with perforation into the bronchus, tracheotomy, and recovery. He also collected nineteen other cases of bronchial gland tuberculosis, in seven of which tracheotomy was done with three immediate deaths, two late deaths after nystagmus and two recoveries.

As to the anatomy, Sukiennikow describes four groups of glands, one to the right of the tracheobronchial bifurcation, one to the left and one below. They receive their lymph both

from the trachea and bronchi. The fourth group is made up of one or more glands in the angles of the primary and secondary bronchi and receives lymph from the bronchi and the lung tissue.

Clinically it is worthy of note that there is no anatomic connection between the jugular chain of glands and the bronchial glands.

Kälble has demonstrated the presence of tubercle bacilli in apparently healthy bronchial glands of persons who had died of accident, the incidence being as high as 8 per cent.

While glandular tuberculosis occurs much more frequently in childhood and invades neighboring organs, the anthracotic glands of adults have a much greater tendency to invade the trachea than tuberculous glands. Thus in Sternberg's thirty-six autopsies (comprehending 6,132 necropsies) showing perforation into the bronchi, thirty-four were cases of anthracosis, and only two were tuberculosis. In 1,800 postmortems at Middlesex Hospital, Lodon, six cases of perforation were found, three of them in children. Seven hundred and ninety-six autopsies collated from German sources included twenty-five cases of perforation. Some of the statistics indicate that the right bronchus is perforated more often than the left. Schmiegelow reports four cases.

Case 1 was in a boy, two and one-half years old, who drank soda lye, resulting in an esophageal stricture. Subsequently tracheoscopy showed marked compression of the trachea and right bronchus, with pus and granulations near the bifurcation indicating a suppurating gland, which might or might not have been tuberculous.

Case 2, a girl, aged six years, was taken suddenly ill with dyspnea and cyanosis. Tracheotomy was done, but the patient died. At autopsy she was found to have an old tuberculous focus in the right apex, and caseous tuberculous adenitis around the right bronchus with perforation into the latter.

Case 3 was a young woman of eighteen years, who had dyspnea attributed to laryngeal stenosis. By direct bronchoscopy it was found that she had a compression stricture of the right main bronchus produced by a large broken down tuberculous gland which had perforated. After a prolonged illness an apparent clinical cure resulted.

Case 4, a boy of eight months, was considered to be one of croup. Tracheotomy was followed by death three weeks later. Postmortem revealed a stenosis of the trachea by compression from a noninflammatory but hyperplastic lymphatic gland the size of a walnut; no perforation. No glandular hyperplasia elsewhere.

Twenty cases collected from the literature are epitomized and tabulated. A. Miller.

Oscillatory Nystagmus.

WITMER, J.

Klin. Monatsbl. f. Augenh., 1916—361.

A peculiar form of nystagmus is reported in a twenty-eight-year-old Ulan, who was injured above the forehead by a fragment of a bomb. After six weeks he was again declared fit for service. Two months later he was thrown from his horse, striking his head. After regaining consciousness, he became dizzy, everything seeming to tremble, and since then he suffered from headaches and constant vertigo, having difficulty in walking. There was a scar in the middle of the coronal suture, slightly adherent to the bone, which showed a small, shallow depression. Otherwise the man was strong and healthy. Family history negative. Both eyes appeared normal, but at regular intervals of about one second there occurred extraordinarily rapid, uncountable nystagmoid jerkings. These rapid oscillations (about 6-8) would occupy a phase of about half a second, followed by a phase of rest of equal duration. They seemed to be in a horizontal direction, with an excursion of not more than 0.5-1 m. m. The oscillations continued, even when the lids were closed; but when they were passively opened while tightly squeezed together, the nystagmus disappeared almost entirely. During sleep there was no nystagmus. There was no relation between the frequency of the nystagmus and the pulse. Both eyes were normal, except for a slight hyperopic astigmatism. Vision equals 6/8. (After correction, 6/5.) Atropinizing the eye had no influence on the nystagmus, nor did the direction of gaze. Otologic and neurologic examination revealed no organic lesion. During four months of observation the nystagmus did not change, but

the patient could walk without his cane. His gait was normal. The author holds that we must infer a disturbance of the center of convergence and accommodation, or of the tracts radiating therefrom. The nature of this disturbance, whether organic or functional, cannot be determined. He was able to find only one other similar case in the literature.

An Original Device for the Control of Hemorrhage From the Large Sinuses of the Brain by Invulsion of the Outer Wall Into the Lumen.

EAGLETON, WELLS P.

Med. Rec., N. Y., 1919—XCV—274.

The appliance holds the two ends of the suture apart so as not to compress the fixed dural attachments, while the descent of a metal obturator causes an invulsion of the outer wall of the sinus into its cavity, obliterating its lumen.

A small opening is made in the dura, on each side of the sinus, using a triangular dural knife or cystotome. A ligature is passed from one dural opening to the other, using a full curved needle with the point blunted, damage to the cerebral tissue being avoided by hugging the dural surface. One side of the ligature is knotted in its center and the suture placed in the slot of the carrier and of the obturator of the same side. The other side of the ligature is then placed in the opposite slots, and, using the knotted point of the ligature as a fulcrum, is tightened sufficiently to cause slight indentation of the sinus; when the ends of the ligature are tied in a bow knot over the cross-arm of the carrier. Tightening the upper screw of the carrier will cause the descent of the obturator into the sinus, obliterating its cavity. Using an artery clamp, the slots in the soft metal arms of the obturator are then pressed firmly against the suture, holding it in position; the suture above is then loosened and removed from the slots of the carrier, and the obturator is liberated from the carrier by unscrewing the lower screw. (The suture may now be tied over the obturator.) If the ligation is to be made above the knee it will be necessary, in addition, to perforate the tentorium cerebelli with the needle.

The upper portion having been obliterated, and all downward current of blood stopped, the lower portion of the sinus is easily ligated, as the sinus walls are here much nearer; or if the bony exposure is low enough the lower portion of the sinus may be obliterated by the pressure of a tampon against its firm bony wall. Between the two ligatures the sinus can be incised.

The obliteration of the sinus frees the approach to the anterior triangle of the cerebellar fossa, making possible the enlargement of the dural incision in front of the sinus. Through the enlarged triangle the whole of the inner side of the dura over the anterior surface of the cerebellum can be inspected and the region of the adjacent cerebellum (the most frequent site of cerebellar abscess) exposed.

The writer presents the history of a case of cerebellar abscess in which this device was successfully used.

Emil Mayer.

Absorption of Volatile Substances.

ZWAARDEMAKER, H.

Acta Otolaryngologica, 1918—I—54.

Odorous substances have the following properties: (1) Their molecular weight varies between 17 (ammonia) and 300 (alkaloids). (2) They are volatile at ordinary temperatures. (3) In the gaseous state they are quickly diffused. (4) They are absorbed by the walls of the spaces filled by the gas. (5) They are soluble in water (sometimes only slightly) and in oil (almost invariably). (6) They lower the surface tension of water.

After discussing at some length the physical and electrical properties of odorous vapors the author points out certain factors determining the acuity of olfaction, such as the lowering of the surface tension of the mucus covered nasal mucosa (the amount of nasal secretion thus becoming important), and the passage of the odorous particles from the layer of secretion on the mucosa into the olfactory cells where they are dissolved in the lipoids of the cells. He suggests that absence of absorption may be a fundamental cause of essential anosmia.

A. Miller.

Persistent Thymus in Exophthalmic Goiter.

TEBBUTT, A. H.

Med. J. Australia, Sydney, November 23, 1918.

A woman, aged twenty-two years, had right lobe of thyroid gland removed for relief of symptoms of Graves' disease. Twelve hours later she became cyanosed; artificial respiration failed. Autopsy: Persistent thymus of unusual size. Question: Was death due to (1) tracheostenosis from pressure, (2) hyperthyroidism, or (3) status lymphaticus? A. J. Brady.

Epidemic Meningitis and Detection of Meningococcus Carriers.

SCHORER, EDWIN HENRY

J. Am. M. Ass., Chicago, 1919—LXXII—645.

Detection of carriers is possible and practical and has marked advantages over quarantining of contacts, as has been generally practiced. Cultures of large numbers of troops can be taken with a high percentage of efficiency, and to get the best results it is necessary to take cultures of whole organizations rather than only contacts. The taking of cultures of large numbers of persons at one time has been necessary, and at this time we are taking cultures for diphtheria bacilli of all sick and wounded returning from overseas (from 4,000 to 5,000 a week and up to 2,000 at a time), and getting results showing high efficiency of work on a massive basis. There is no evidence that the results on our large numbers of cultures were less accurate than were the results of other workers who took cultures of only a few at a time. In fact, we got better results when we were hard pushed than when we had less work, for when there was much to do the officers were more keen.

The taking of cultures of whole organizations or even entire camps, need not interfere with military training; taking out the carriers and putting them in a carrier camp interferes less than quarantining even only the contacts.

Detecting and taking the carriers out of organizations is of value, and the routine taking of cultures of the whole command seems indicated if the troops come from areas where epidemic meningitis is endemic.

Detected carriers have the disease, but our data seem to show that those that developed the disease were already in the incubation period when the cultures were taken. We have no evidence that chronic carriers developed the disease.

The cotton swab on a straight wooden applicator, the cultures being taken from the nasopharynx through the nose, gave us good results, and its use is much more feasible than the West tube and bent wire applicators when cultures of large numbers of troops are to be taken.

False Teeth as Cause of Cancer.

FIELD, C. E.

Med. Rec., N. Y., 1919—XCV—275.

The basis of the writer's report is an analysis of a series of 87 clinical cases coming under his observation, in which the initial ulcération or nodule was in close proximity to an artificial denture of which the patient offered complaint. Nineteen showed original development of the tumor adjacent to bridge work and 65 near plate work of various types. The malignancy presented in 59 cases in the superior maxilla, as against 28 affecting the inferior maxillary region. The tumors were classified as follows: Carcinoma, 65; sarcoma, 9; osteoma, 3; fibroma, 4; chondroma, 4, and melanosarcoma, 2.

Emil Mayer.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of Tuesday, December 17, 1918.

THE VICE-PRESIDENT, DR. CHARLES H. LONG, IN THE CHAIR.

DR. HARRY KAHN demonstrated a new otoscope.

Paper: Report of a Case of Suppurative Labyrinthitis and Tuberculoma of the Cerebellopontine Angle, Cerebellar Abscess, With Miliary Tuberculosis of the Lungs, Spleen, Kidneys and Intestines.*

BY L. W. DEAN, M. D.

Paper: The Proper Procedure for External Drainage of Retropharyngeal Abscess Secondary to Caries of the Vertebræ.†

BY L. W. DEAN, M. D.

DISCUSSION.

DR. ALFRED LEWY asked if, after they were through the fascia, all the rest of the operation was done with the finger.

DR. DEAN replied that he went in with the finger and found the abscess, which was just like a full bag in front of the finger, and he then inserted any blunt instrument which would do no damage and lacerated the sac.

DR. HARRY KAHN was not sure whether he had understood Dr. Dean to say that all retropharyngeal abscesses should be drained externally. In some experience with such abscesses he had used an opening through the mouth, but with blunt artery forceps as recommended by Abt. His practice had been to make the opening using the finger first as guide and then pressing the forceps into the mass, opening them and allowing the pus to flow out. The child was held with the body

*See page 514. †See page 566.

raised and the head down. No difficulty had ever arisen from the aspiration of pus. The child was put to bed with the head down and kept in that position until the abscess completely drained. Good results had been obtained by this method, and he did not remember any ill results. The patients recovered in a few days and the glands disappeared. Occasionally a case had required a second stab, and once in a great while a third, but they had had no fatality.

DR. ROBERT SONNENSCHEIN understood that the paper referred to cases where there had been caries of the vertebræ and not to ordinary abscesses.

It was important to remember that in retropharyngeal abscesses the pus may be differently located, depending on the origin of the infection.

In the usual cases the abscess arose from infected lymph glands lying in the region of the pharynx. In such instances the pus formed between the prevertebral muscle and the pharyngeal mucosa and tended to point toward the pharynx. The treatment here, of course, was opening the abscess by the usual incision in the throat. But where a caries of a vertebral body was the cause of the pus, and the latter lies behind the prevertebral muscles and may burrow down towards the mediastinum, the operation so well described and perfected by Dr. Dean ought, it seemed, to be decidedly indicated.

DR. DEAN stated that the title of the paper conveyed that impression, but that in the course of it he had stated that as the procedure was so simple, in his judgment it was the best, and he was opening all retropharyngeal abscesses by the external route. He did not wish to make this a dogmatic statement, because so many men with much experience were doing the internal operation.

DR. A. A. HAYDEN thought the presentation of the subject of retropharyngeal abscess that Dr. Dean had given the society was indeed interesting. The advantage of this method in the treatment of abscesses low down, especially when they were large and accompanied by bone necrosis, was obvious.

Where the abscess was located higher up, however, the old method of incision through the mouth was a satisfactory and safe surgical procedure, if done under proper precautions. Most important among these were the use of an efficient suc-

tion machine and the immediate lowering of the head (if a child, holding up by the heels), so that none of the pus could be aspirated into the lungs to invite septic aspiration pneumonia.

Dr. J. Gordon Wilson said that the society was indebted to Dr. Dean for the history and postmortem findings of this interesting case. It presented a distinct lesion of the peripheral end organ of the right eighth nerve and a tumor of the right cerebellopontine angle with changes in the cerebellum. There was, as there so often is, a combination of cerebellar nystagmus and labyrinthine nystagmus. On looking to the left, the direction of most conspicuous labyrinth oscillation, we had the labyrinthine type predominating; on looking to the right, the minimum of conspicuous labyrinth oscillation, and so the predominance of the cerebellar type. It was now generally accepted by physiologists and neurologists that the cerebellar and labyrinthine types differ, as Dr. Pike and Dr. Wilson first demonstrated some years ago. In the labyrinthine nystagmus one saw the slow quick type, and in the cerebellar, the ataxic type. The difficulty was that in so many of our clinical cases of tumor we have a combination of the two. This case showed how a careful observer could arrive at a clear view of what was present. As stated elsewhere, for many years Dr. Wilson had used glasses of 18 diopters to cut out fixation and more easily differentiate the two types. Dr. Dean was puzzled as to why the patient lay on the right side. It might be assumed that he was most comfortable on that side—that on that side the vertigo was at its minimum. Dr. Wilson recalled to Dr. Dean's attention his experimental findings where (a) the left half of the cerebellum was removed, and (b) the left labyrinth was removed. As a rule, in the former, the animal preferred to lie on the right side and in the latter on the left. (Wilson and Pike, "The Relation of the Labyrinth to the Cerebellum and the Cerebrum." The Transactions of the American Otological Society, 1914, page 6.) This case furnished interesting information which, as Dr. Dean shows, must be interpreted in the light of physiologic knowledge.

Dr. Wilson never was called on to operate on a case of caries of the vertebræ. However, within the last two years, as an otologist, he had been able to diagnosticate two cases of

early vertebral caries on account of pain in the ear. It should not be astonishing to find that pain in the ear might be an early symptom of caries, since fibers of the second cervical nerve are distributed to the region of the ear.

DR. OTTO J. STEIN was reminded by Dr. Wilson's remark concerning pain in the cases of beginning vertebral caries, of a case he had of retropharyngeal abscess due to middle ear involvement, which was a well known condition, but he did not believe it had been touched upon. It was possible to have such an abscess form behind the vertebræ and it could dissect its way down, following the canal and going in behind the fascia. That type of abscess should be borne in mind in these cases. He complimented Dr. Dean upon his method of procedure and thought it was one of the greatest advances in the treatment of retropharyngeal abscesses. He considered the points brought up by Dr. Wilson exceedingly interesting.

DR. ROBERT SONNENSCHEIN asked whether Dr. Dean curetted the bodies of the vertebra.

DR. CHARLES H. LONG inquired as to whether any effort had been made to determine the cause of the caries and how long it took for it to clear up.

DR. L. W. DEAN (closing) said his only excuse for giving this paper at this time was because the recent article in the English Journal had seemed to him so erroneous. He had had it mind for three or four years, and after reading this article had decided to present it at this time. All of their cases had been secondary to bone tuberculosis and came from the orthopedic department, where they had been treated for that disease.

They had not curetted the bodies of the vertebra in any case but simply inserted the drainage tube. Most of the cases had disappeared from their service or had died with the usual symptoms. The fact that these did not clear up but kept constantly discharging illustrated to him the necessity for doing an external operation for tuberculous processes. He had seen cases of tuberculous caries that had been opened into that for months and months continued to discharge tuberculous material into the pharynx, which was very bad for the patient.

A suggestion was made that they go to the bottom of the abscess. When they go in, they find that they can go to the

top and bottom with the finger, and sometimes drainage tubes are placed both up and down. Very frequently the abscesses extend much further than is suspected preceding operation.

Paper: The Ear, Nose and Throat Examinations of Aviators, With Special Reference to the Technic of Vestibular Reaction.*

By Austin A. Hayden, M. D.

DISCUSSION.

Dr. Alfred Lewy said that Dr. Hayden and he were associated in the work for many months. Every once in a while they would find a doubtful case and would check up on each other. Sometimes their findings did not agree; sometimes they retested their own cases and obtained a different result the second trial. This led them to think the subject over, and they came to the conclusion that there was something in the interpretation of the test, even after the rigid rules of technic that were followed. Dr. Lewy was of the opinion that any test that was severe enough to bring about pallor, tremor, sweating, muscular relaxation and vomiting, was also severe enough to derange the end organ under examination, and its connections, probably through vasomotor disturbances, and thus in some cases defeat itself. This would account for some of the failures. On the other hand, some men would not respond to the test; particularly would they fail to past-point, although normal in every way. He believed that these men had superior control, but Dr. Isaac Jones believed it was due to an insensitive labyrinth. Dr. Lewy was glad to hear Dr. Hayden state that Dr. Fisher had said that men could become immune to the past-pointing, as it supported the theory of superior control. Col. Lewis had also said that some men could maintain control in spite of vertigo, and be able to touch the testing finger.

They examined two or three aviators who had been in service but had to be retested because their papers were lost or the physical examination was incomplete, and occasionally would find a man who had had considerable experience with flying of various kinds—dips, spirals, tail spins, etc.—and came out

*See page 518.

all right, but he would fail to do the past-pointing. He was of the opinion that they were also cases of superior control.

In regard to Dr. Pierce's observation that the nystagmus stopped with the onset of vomiting, that also stopped the past-pointing in a few instances.

The blindfold was necessary not only to keep the patient from opening his eyes and seeing where the finger was, but also to keep him from orienting himself by a window or a light of some sort. He could see a light through his closed lids. It was also necessary to keep the room very quiet, for they might be able to orient themselves by the direction of the sound of a voice observed before being put on the chair. Another great value of the test lay in its application in diagnosis. There was still a great diversity of opinion as to just how much value the test had. Jones and Fisher had been able to locate lesions where neurologists had failed. Some other neurologists had made the statement that no information had been obtained through the Bárány test that they had not obtained by other well established tests.

The question asked of Dr. Dean regarding test of the superior canal of the opposite side was because of the claim of Jones and Fisher that that was one of the points of differentiation of the cerebellopontine angle tumor, but Dr. Wilson did not seem to take any stock in it.

He cited two rather interesting cases seen recently, one of them in a physician who had been troubled with vertigo for about three years. The interesting thing about the case was that he had never been seasick; he was on a sailing ship as a boy, and stood up in the crow's nest without any seasickness. He had had mumps and some other infectious diseases and was a heavy smoker. His hearing was nearly normal except that bone conduction was somewhat shortened. There was no sensation of vertigo and no past-pointing or falling, and yet his hearing was quite good in both ears. He had had numerous Wassermann tests on the blood and spinal fluid, all of which were negative. The case was diagnosed by a neurologist as either petit mal or brain tumor of indefinite location. There was no choked disc or other sign of intracranial lesion except vertigo and ataxia. He was inclined to believe that it was a double toxic neuritis attacking the vestibular nerve. He heard

later that the patient greatly improved after discontinuing the use of tobacco.

The other case was a man of thirty-five, a supposed syphilitic, who was attacked suddenly with nausea, vomiting and collapse. When he examined him he was unable to obtain any reaction by means of the caloric test, but by the turning test got reaction. The only tuning fork finding was a shortened bone conduction. He did not know what the lesion was or where it was, but the patient gave a positive test for syphilis in their laboratory, a negative in another, and was under treatment for that disease. This patient's vertigo was ameliorated after correction of hypermetropic astigmatism.

Dr. J. Gordon Wilson said pointing is primarily a cerebral action. It was not a subconscious act, but a conscious attempt to reach an object, and like most cerebral acts was capable of education. In this, Dr. Hayden was correct. To show the close connection between pointing and vertigo, three or four years ago Dr. Wilson demonstrated a case in which a man had been shot through the cerebellum. He had no past-pointing. In this case, nystagmus could be produced easily but no past-pointing. With great difficulty could vertigo be produced and only when vertigo was present could past-pointing be demonstrated.

Dr. Hayden had suggested that this paper might be by some regarded as a little too late, since the war was over. On the contrary, this paper was not inopportune, because we still want aviators. At the initial stage of the war, some had the idea that the ear was the great test, but as time had gone on it had become clear that this was not so all important as was thought. The question of tests for aviators was a very large one, and otologists were asked how much reliance can be placed on labyrinthine tests. It was known that flyers might come out of a cloud upside down or leaning distinctly to one side. The amount of dependence to be placed on labyrinthine tests depended on a clear recognition of the fundamental physiologic function of the labyrinth. Let it be remembered that the ordinary afferent impulses from the labyrinth were not conscious but subconscious. The canal tells not of rotation but acceleration of rotation. The static labyrinth is concerned with keeping the head right side up. Only when these

activities are exaggerated or when attention is fixed on the head movements do they become conscious. It was well in our claims to recognize the limitations of the labyrinth as a guide.

One other point in the paper required recognition. It gave clearly checked up observations of two men working together. One man unconsciously may color what he finds; checked statistics are more reliable. He admired the amount of work that Dr. Hayden and his colleague had done and congratulated them on time well spent.

DR. HARRY KAHN asked if different results were obtained in the same individual on the same day.

DR. HAYDEN replied that they had tried not to make the same test on the same man more than once on any one day.

All cases which showed doubtful, indefinite or abnormal rotation reactions were tested calorically, cold water at 68 degrees F. being routinely used. The right ear was douched one day and the left ear the following. This precaution was followed to prevent the candidates becoming unduly nauseated. Nystagmus and past-pointing were taken with the head 30 degrees forward and then 60 degrees backward. Past-pointing was also taken with the candidate's head on his knees, with the forearm only. Here the observation of nystagmus was almost impossible. For convenience, these positions were designated as the first (head 30 degrees forward), second (head 60 degrees backward), and third (head on knees).

In reply to Dr. Wilson, the candidate at the beginning sensed properly the direction (let us say to the right) in which he was being turned. He felt that he was standing perfectly still as soon as the rapidity of endolymph movement caught up with the speed of the chair, and that he was going in the opposite direction (to the left) as soon as the chair was stopped. For that reason he reached around to the right past the observer's finger (i. e., past-pointed) to make allowance for his fancied excursion to the left. This sensation continued until the endolymph movement ceased. Thus systematic past-pointing depended entirely on vertigo.

While falling and past-pointing were primarily objective symptoms of vertigo, they may at the same time possess a subjective element. For that very reason the past-pointing and falling reactions may be suppressed to a greater or less

degree by the candidate, especially if his labyrinth was not overly sensitive and if he had been turned on previous occasions. Lewis Fisher had recently observed in his work at Mineola, how experienced flyers had learned to assume certain positions in their machines that enabled them to do even the "spiral" and "nose dives" without becoming dangerously dizzy. The vestibular tests may be of considerable value in the future for the scientific selection of pilots for commercial purposes. Aerial navigation was just in its infancy now. Its possibilities, advanced as they have been at least a hundred years by the recent war, were almost boundless.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of Tuesday, February 18, 1919

THE PRESIDENT, DR. ELMER L. KENYON, IN THE CHAIR.

DR. WALTER B. SWIFT of Boston addressed the society on

Problems Involving the Nasality of the Human Voice.

Dr. Swift appreciated the fact that he had been requested to address the society and thought this pointed to the fact that men were becoming interested in some of the more complex things that were inside the specialty. Speech defects had been left to the end of our study because the subject was considered absolutely too complex and hard to analyze, but in the last few years that attitude had largely changed and medical men were having their eyes opened to the simplicity of the things that looked so complex before. He considered speech a function of this specialty and thought that by understanding and trying to build up the capacities of the function they would not only become finer and more thorough throat and ear men, but that it would be of value financially and in research. The subject of speech defects was much like the nervous system in medicine. The nervous system was left unstudied and unknown for many years, but twenty or twenty-five years ago people went into it, and things that formerly could not be recognized were now easy to understand, so much so that there was now a recognized system of diagnosis of nervous disorders. This complex field was opened out, and its parts separated and divided so that the parts could be seen and analyzed and one could make scientific judgment upon it.

The same thing had occurred in speech until now it is fairly easy to diagnose defects and build up functions. He hoped that the members of the society would become interested in the relationship of this work to public school work. He was devoting his entire time to speech disorders, for it seemed to him he saw a large field unplowed. There was no field in medicine that was so interesting as this field of speech. There was a national organization composed of about two hundred

and fifty members that had been in existence for about four years, and up to date four hundred and thirty papers had been read in that organization.

In Chicago public schools they are endeavoring to build up a plan similar to the one in operation in Cleveland, where they had a large and successful speech department in the public schools. There they had three thousand cases with fifteen teachers who were trained to do the work. Here in Chicago the cases were not taken care of until they were in the higher grades, and that was largely without diagnosis. In Cleveland they have diagnosis and also a movement for prevention, which was a new idea in speech correction. They begin by training speech cases in the kindergarten and expect in that way to prevent from one-half to three-fourths of the cases of speech disorder higher up. This was very interesting and valuable, and they hoped to be able to amplify and perhaps improve on it in Chicago. There ought to be a good deal of expert diagnosis in these cases because speech correction could not be established without portraying the causes behind it. The diagnosis of paralysis, of Mongolian idiocy and all other diseases was of great value, and no program of speech correction in the public school was reliable or what it should be without the diagnosis in the background. They wanted to have Chicago an example to the world, and with such an able representative as Dr. Kenyon in the field this could be accomplished here. There were enough men interested to accomplish these things if they worked in collaboration.

Dr. Swift described in some detail the various different forms of speech defects. He believed that speech correction was now being taken up in a more scientific way than ever before. At the present time Cleveland stood as a model for speech correction for America, but they hoped to have even a better department in Chicago. At present no city had the movement for speech defect prevention that they had in Cleveland, no other city had speech correction taught in two normal schools as they had there, and no other city had speech correction inserted into the regular school grades as there. It was not merely a mouth treatment; but when done in the modern way was largely mental upbuilding. It built up the visual perceptions and a more acute ear than was ever the

case before, especially in the teachers who studied the subject. In the Cleveland schools they had "part time" teachers who did this work part of the time in the afternoons, and he considered this better than having special teachers for speech correction. After careful analysis they had come to the conclusion that this was the most efficient way to attack this problem.

There were four fields or faults to be dealt with in the nasality of the human voice—"Obstruction Nasality," "Destruction Nasality," "Misdirection Nasality" and "Misplacement Nasality," and all must be treated in different ways.

Paper: The Efficiency of the Modern Velum Obturator.*

By Calvin S. Case, M. D.

DISCUSSION.

Dr. Elmer L. Kenyon stated that a gentleman had consulted him without announcing that he had come from Dr. Case, but saying that he wished to speak about treatment for his mother. The purpose of the patient was to have Dr. Kenyon hear him speak without knowing that there was any disturbance of the voice. Dr. Kenyon listened while the gentleman explained about the trouble of his mother, but after a time asked him whether he had come because of his voice. Dr. Kenyon recognized the fact that the gentleman had some palatal defect, but the quality of the voice was something he had never heard in an adult cleft palate patient before excepting a very few times. Dr. Kenyon regretted very greatly the impossibility of demonstration of this interesting and remarkable case. The obturator rode upon the palate, covering over the extensive cleft; it moved up and down, being carried by the elevators and depressors of the soft palate, as if it were a part of the organ itself.

The thing that had impressed him with reference to cleft palate work was that the cleft palate operator often insisted upon destroying the function of the elevators of the palate, and this was exactly what Dr. Case did not do. No palate

*See page 555

could functionate normally where the action of the elevators was completely or nearly destroyed. In the case referred to there was comparatively free action of the soft palate, and the result was very fine with reference to the voice.

Dr. Kenyon spoke of the need of voice training in cleft palate patients—why did nearly all need voice training, even though the palatal defect had been largely corrected? The acquirement of accuracy of articulation with the confusional sounds and the defective anatomic conditions resulting from a defective palate was usually only partly possible. Both the sensory and the motor word centers became wrongly educated and the patient after a time failed to appreciate his own articulative errors. It thus became necessary to reeducate both these centers in order to correct their own errors.

He mentioned a case of tonsillectomy in a child of six. The child talked with a nasal voice and had always done so. The patient came from Dr. Truman W. Brophy, who had found no palatal deformity. The palate was shorter than normal, and the child had thus formed the habit of nasality. An operator on the tonsils had come along—and that was inevitable these days, and one reason why these speech troubles should be introduced into laryngologic meetings—the inevitable operator had performed tonsillectomy and adenectomy. If operation had not been undertaken, training of the feebly acting soft palate would have been easier and much more certain of success. The extirpation of the adenoids, which were of positive usefulness in the training of this patient's voice, was clearly contraindicated, at any rate at this time. What happened in the course of the operating—and it happened over and over again—was that the palate, already too short, was so stiffened up by retraction of the one posterior pillar that now the hope of improvement in the child's voice was much reduced. The laryngologist evidently did not realize that the operation was a serious matter in this child and should be undertaken, if undertaken at all, with exceptional care.

A second case was somewhat similar and also came from Dr. Brophy. The patient was a man of thirty-six or thirty-seven years, whose palate had been operated upon seven or eight times in his adult years by Dr. Brophy; and the patient was here from out of town to be operated again. The work

done upon the palate had been very extensive and could hardly have been improved upon. The palate had been entirely reconstructed. It was a remarkable piece of work, but adhesions had occurred between the soft palate and the posterior wall, so that the opening to the nasopharynx was now not more than half an inch in diameter. Dr. Brophy was intending to enlarge this opening because of the patient's difficulty in breathing through the nose. The voice was nasal but not markedly so. Dr. Brophy was of the opinion that the reason he could not breathe through the nose was on account of the palate adhesions. Examination of the nose showed that a marked deflection of the septum existed on one side, and a very large lower turbinate on the other; the breathing space was thereby greatly diminished. What would be the proper procedure from the standpoint of the laryngologist in such a case? Probably nine-tenths would say, "Straighten the septum and give the patient a normal breathing space," but Dr. Kenyon did not believe that would be good practice. He suggested to Dr. Brophy that he should be careful about greatly enlarging the palatal opening into the nasopharynx and that operation in the nose should be undertaken with extreme conservatism. If the patient was operated upon at all it should be with the idea of keeping the nasal space not broad, but relatively narrow, because in proportion as the nasal space was made broad would the abnormal resonance tend to be increased.

In reference to operating upon the palate, he was not a palatal operator and made suggestions with a good deal of diffidence. He had been impressed with one thing through the examination of many tonsillectomized throats, and thought he had learned something by examination of these throats which might eventually be of advantage in pointing to a better procedure for palatal operating. He had become convinced that many of these little tonsillectomized patients would have spoken with a nasal voice if they had had to depend upon their soft palates alone to prevent such a voice. A certain portion of these patients spoke with a normal voice because they had struggled to learn a new procedure for correcting their impaired nasal voice. This consisted in using the upper portion of the superior constrictor muscle to take the place of what had before the operation been present as the posterior

pillars. The elevators of the palate acted and drew the palate up, but the traumatized palate was too short to close the naso-pharyngeal opening. The superior constrictors closed in at the side and served to take the place of the destroyed pillars. He thought that possibly one could produce a palate, not of the great length which the operators now attempt to get, but a shorter palate higher up, and without destruction of the raising function of the palatal elevators, and then through training bring these constrictor muscles to fill in at the sides what the palate could not accomplish. While that would not produce a perfect voice, there was hope that it would produce a better voice than often results by the present procedure. The cause of extreme nasality was the large relative proportion of space for the air to go through the nose as compared with that for the mouth. If a process could be brought about whereby the space for the air to go out of the nose was small and out of the mouth was markedly large, that was in many cases all one could hope to accomplish; and this would be encouraged by building the palate up as near the roof of the mouth as possible.

Dr. Kenyon expressed his appreciation to Dr. Swift for his coming to Chicago to address the society, and also for his work in connection with speech defects in the public schools of various cities.

Dr. Robert Sonnenschein said the fact that the study and appreciation of voice defects required a highly trained man in every sense was demonstrated to him during the course he had the privilege of taking in Berlin, in 1910, under Professor Gutzmann. In this field were combined the qualities of the neurologist, the physiologist and the laryngologist. He wanted to learn in a general way what he could in order to appreciate the difficulties they have to contend with. He thought we were fortunate in having in this city a man like Dr. Kenyon and in the East a man like Dr. Swift, who had undertaken the treatment of these diseases. It had seemed a pity to him that so many of his colleagues had neglected the study of these cases, and the reference of them to men who could treat them properly, but had left them to the mercy of the advertising charlatans, who could not get proper results, as they did not treat the patients scientifically.

With reference to the cases Dr. Kenyon mentioned, he wondered if Eckstein of Berlin, with whom he had a little paraffin work, would not advise that method. He had had good results with paraffin—the hard paraffin which melts at or above 52° C. The great objection to these operations had been the embolism which had occurred, oftentimes with complete blindness of the retina, but this had occurred with the soft paraffin. The hard paraffin had practically never caused amaurosis. He had seen Eckstein inject a mass of paraffin in these cases where there was lack of proper functioning of the palate. This permitted a contact of the soft palate and greatly improved the voice. This was a simple procedure with the paraffin melted and injected. The paraffin hardened almost immediately and the cases he saw in the clinic seemed to functionate very well.

DR. H. L. POLLOCK said in reference to what Dr. Sonnenschein had stated that they had seen many of those palates. One case was that of a woman who had been operated and wanted to have her voice corrected. They followed the procedure of injecting paraffin and obtained an almost perfect voice. The palate was short and stiff, as was often the case, and the principal difficulty was in getting the proper amount of paraffin. It was almost like injecting it into the septum. They injected a little and in a few days a little more; there was less and less reaction with each injection, and finally the voice became almost perfect. In subsequent operations they had not obtained as good results, but in the case of short palates it did improve the voice materially. If the palate would not move towards the pharyngeal wall this procedure would bring the wall toward the palate, and he thought it was the only thing that could be done after the cases had been operated.

Another thing was the matter of training these individuals' voices properly. In nearly all cleft palate cases where there was a nasal twang the patient seemed to be unconscious of this. The patient would repeat what was told him and repeat it with a nasal twang, and think he was saying it properly. In one case, a young man of twenty-one, who had had several operations and all but a very small opening was closed, there was a distinct nasal twang of which the patient seemed to be entirely unaware. They procured a phonograph record and

had him read a poem into it and then had his listen to the record, and he could not recognize his voice. These patients were under the impression that they were speaking as distinctly as anyone, and this young man thought he was speaking correctly until he heard the reproduction of his voice in the phonograph.

DR. ARTHUR M. CORWIN thought that with the exception of Dr. Kenyon, the members in general knew very little about the subject of these excellent papers. Dr. Kenyon had given it careful, intensive study, and this was bearing fruit out of the years. One peculiar thing was that he trained a great many of the little defectives, who were not necessarily anatomically defectives but "habit defectives," and in order to train them he had to bring into play in an intensive way his own articulation, and in the course of a few years he (Dr. Corwin) had noticed an immense progress in his (Dr. Kenyon's) use of his lips and palate and tongue, in the clearness of his enunciation, and that was one of the reactions that a teacher-student would always get.

Since the first of January, Dr. Corwin had been giving his services once a week for twenty-five weeks to the Y. M. C. A. in Oak Park as a director of public speaking (although he had never done anything like this before in his life). There were thirty-five men in the class, ranging from fifty-five to eighteen, business men, salesmen of insurance and real estate, physicians, lawyers, etc. Several of them had speech defects, some had a nasal twang. These men got up and made their two minute speeches, and then Dr. Corwin criticised them, and it was astonishing to see the progress those men had made in six or seven sessions, not only in handling themselves, but in the art of expression. Sometimes he took certain men aside and gave them special suggestions and criticisms.

He believed people with speech defects should be watched for and referred to the men who could give them the necessary training in the most scientific way.

DR. D. P. MACMILLAN, director of Child Study of the Chicago Public Schools, said that he had been following the work of Dr. Swift very closely for the last two years, and had been very much interested in the undertaking that was going on in Cleveland. They had endeavored to get some such measure

inaugurated in Chicago. At present there were only eleven teachers, were devoted their time to the correction of minor speech defects. The problem cases went to him for advice, and he "parceled them out," provided he could not give them individual attention. To give such individual attention to two hundred and forty or two hundred and forty-five a year, as well as to see forty-four hundred or forty-five hundred other kinds of defects meant that a great deal of intensive work must be done by some agency. He would like to have an organization especially correlated with what is already being done to look after that work, and he believed it was necessary to do this in order to take care of the great number of speech defects among children. This was particularly true because they do not go back and attack the defects early and establish some form of treatment that would prevent or cure them.

The problem of cleft palate under discussion was a minor one for his department—that was work for the pathologist. When a child came to the attention of the department that was mentally subnormal as well as defective in speech, they found it best to refer him directly to a pathologist for treatment as well as to the teacher of correctional speech. The work of caring for the speech defects as it now obtains was defective in many ways, but he was not able in the time allotted, even though it were wise so to do, to detail all the shortcomings. As a matter of plain fact, it was essential to have a movement promoted for the correction of speech among normal people who were supposed to have correct speech. It was eminently necessary to have training in voice control and in public speaking. However, it should be remembered that the number of cases associated with nervous disorders was great, 67 per cent among twenty-seven hundred investigated, which raised the larger question of the intimate relation of these speech defects to general constitutional and neural disorders. Should this work be associated with the correction of speech among deaf pupils? He did not know the attitude of the Cleveland people upon this subject, and asked whether the scheme there was so extensive as to take in the speech defects of the deaf and of all pupils from six to eighteen. Also what was meant by a "part time" teacher to which reference was made? He challenged the implication of Dr. Swift's scheme

that it was the early direction of attention to speech defects in and of themselves that was most effective. In some ways the best work in speech control at the present time seemed to be pointed in the line of intensive training for the correction of aural imagery. That raised the question as to whether the time to start the correction of speech was not pretty well pointed out. In Chicago there was great difficulty in getting people to accept any program outlined, particularly in regard to all specialties. Seven or eight years ago a committee came out from New York and became excited about the need for classes for backward children. They accepted a scheme there and it went through, but in Chicago it was partly turned down. They were very slow here to take up the expenditure of money for the inauguration of our present scheme for the correction of speech defects. He hoped that there would eventually be some organization that would cope with the problem of speech correction in its widest sense early in the career of the school child.

DR. SWIFT (closing) expressed his admiration for the splendid paper of Dr. Case. He had noticed one constant and peculiar thing about the cleft palate cases, and that was that a great many of the speech defects occurring in these cases had nothing to do with the cleft palate. He believed that one-half to two-thirds of the faulty speech was entirely outside of the cleft palate etiologically.

He was interested in Dr. Corwin's remarks concerning the improvement in those who trained other voices. When a teacher took a class and trained it her speech and enunciation became much clearer and more distinct and easy than it ever was before, and this also had a direct influence on the members of the class. One of Dr. Swift's teachers who was an assistant in a kindergarten class, where there was no speech correction, said that the supervisor of music found that this class was the only class where she could understand the words the children sang. The Y. M. C. A. was prone to have classes in speech correction, and he considered that a very unfavorable criticism on the academic method of the past and present. Men should not have to be taught how to talk after finishing their school. Speech and its functions was one of the most important things for grown up individuals to have a mastery

of. Many men had plans and thoughts that they would like to get up and talk about in meetings, but they lacked the ability to do it. He thought suggestion was largely to blame for this. When in Harvard, his functions had been largely hearing and writing functions; for four years he was trained to listen and write the thing down quickly and think very little about it. The brain areas used in making that type of individual forced a tremendous development of those areas, but now he did not use them, and he believed he should have been developed into a listening, thinking and talking type of individual.

He was glad that Dr. MacMillan appreciated the need for those things; the feeling of the need for prevention was the most important thing in speech correction. No medical efforts were right unless there was some work instituted along the line of prevention. He had a great fight to put prevention into the Cleveland schools but finally succeeded.

As to referring cases to a pathologist, he understood this to mean that all cases should first be diagnosed by a medical individual and then handed over to the proper teacher. The Cleveland teachers were sufficiently trained to make some of the diagnoses themselves, so they preferred to have the cases go first to the teacher and then to the pathologist if necessary. They had not done anything with the deaf in the public schools. The "part time" teacher was a grade teacher who could keep on with her usual work and devote part of her time to speech correction.

They considered that the kinesthetic approach should come first and this followed up by the development of the acoustic element. Then the visual areas should be brought in and educated to control the speech output, so that when the visual processes were fully developed both of the others were relegated to the unconscious, so that most of the things in the mind of the person when he was talking was the visual element. Some made merely the kinesthetic approach, and some merely the acoustic, and very few the visual.

He agreed that speech correction was very hard to get into the public schools, but thought the wave of Americanism that was sweeping the country might bring it.

NEW YORK OTOLOGICAL SOCIETY.

Meeting of January 28, 1919.

Labyrinth Operation.

DR. PAGE: This was a case of chronic purulent otitis media (left ear) since childhood. She came to Manhattan Clinic in July, 1914, with a large polyp blocking the canal and foul discharge from around it. Admission to the hospital for operation was advised, but refused by the patient. The obstructing polyp was removed in the clinic. The patient did not return until six months later, when canal was again blocked by polyp and there was acute pain in the mastoid. During thesemonths the patient had had repeated attacks of dizziness. A radical labyrinth operation was performed on December 14, 1914, and the rather interesting and satisfactory result obtained is seen at the present time. The procedure followed at operation was the removal of the superior vertical canal and upper wall of the horizontal canal, the lower wall of the horizontal canal being kept intact as a guard against injury to the facial. The vestibule was entered through the ampullæ of the horizontal and superior semicircular canals, these being made into one large opening. The posterior canal was not opened. The bone between the oval and round windows was removed and the promontory gently cut away with a sharp chisel, used with the fingers and not a mallet. Kerrison's instrument had not then been devised. The lining of the cavity in healing is so thin that what was done at the operation stands revealed, with the exception that the opening downward and forward into the vestibule cannot be seen, but the excavation of the superior and horizontal canals can be plainly seen and also the pitlike opening anterior to the facial ridge on the inner wall. Little or no accumulation of epithelium or cerumen takes place in this cavity and a year passed without it being cleaned.

The last time I saw her, she had not been in for a long time, and that is probably due to the large meatus, which allows the epithelium that comes off to fall out. Do you think so, Dr. Dench?

DR. E. B. DENCH: I do.

Dead Labyrinth with Sinuses.

DR. PAGE: This next case is a girl—Helen. In this case, which gives a history of chronic suppurative otitis media since childhood, a radical mastoid operation was performed on the right ear by Dr. Fowler seven years ago. A small area of dura was exposed over the antrum at this operation and considerable disease was found in the tip cells of the mastoid. A year ago she came to the hospital complaining of pain in her left ear. A myringotomy was performed by the house surgeon. On the following day she returned and was admitted to the hospital, giving a history that immediately after the myringotomy she felt very dizzy and deaf. She said that up to this time her left ear had been her better ear and that she had depended on it for hearing. She stated that while the hearing was very much impaired in the left ear after the myringotomy she felt that it was not totally deaf. From Monday until the following Wednesday she was under observation and complained of dizziness when she moved, but showed no marked nystagmus or labyrinthine symptoms. With a noise apparatus in the right ear, she heard a moderately loud voice at arm's length. Because of the acute pain and tenderness in the left ear no further tests were made, and a simple mastoid operation was decided upon, with the hope that her deafness would be relieved when the mastoid had been properly drained and the tympanic swelling had subsided. At this operation a very pneumatic bone was found with all the cells filled with pus. There was marked disease around the aditus with granulations protruding through it. No evidence of malleus or incus could be found, although the external attic wall was removed and the aditus greatly widened. The radical operation was avoided because of the poor hearing complained of in the oposite ear, and the hope was entertained that a dry ear with a fair return of hearing might be obtained by the less radical procedure. The mastoid wound healed promptly and the discharge from the canal ceased, but the hearing did not return and she now has a dead labyrinth with intermittent discharge (not foul) through a large perforation in the drum membrane. The condition present now is a radical mastoid cavity on the right side with a sinus on its inner wall near the facial ridge below the oval window, and a small postauricular

sinus near the tip of the mastoid which heals and opens intermittently. All the hearing is confined to this ear, the left ear having a total loss of hearing and negative caloric reaction. The sound from a fork placed in the left mastoid is referred to the right ear. The drum membrane has a large central perforation through which a thin, mucoid, odorless discharge appears intermittently. The discharge is likely to recur in both ears at any time, and without skillful attention it causes marked irritation and disturbance. I feel a dry ear can be obtained by reoperating on the right ear, but as that is the only ear she can hear with, I hesitate to advise it, as the operation would necessarily be accompanied by considerable traumatism to the region of the oval and round windows, the sinus being located between the two, probably connecting under a false bottom with the tube. In regard to the left ear which is discharging, at the present time the opinion seems to be general that with the dead labyrinth a radical alone should not be performed, but the labyrinth should be opened to provide an exit for any trouble that might be resurrected from the dead labyrinth by the radical operation.

The reason I brought her down here is that when she was admitted she was very unhappy because of the excoriation from her discharge. She is under the care of the New York charitable organization, or some organization of that kind, and is taking care of children in a private family for her board, but she cannot keep her ears clean. I sent her into the hospital for observation and found that by careful, skillful treatment by the nurses there the discharge was kept down, but as soon as she goes away it comes up again and it simply incapacitates her for her duties.

At the present time this sinus in her radical ear—at least, the last time I saw it, three days ago—was entirely healed, closed. It has done that several times and always breaks out again. The sinus, as I said, presents itself close to the facial ridge, between the oval and the round window, and there is another sinus back at the tip of the mastoid which swells up and discharges and heals again. I have never probed around her right ear any more than I could help. I have simply wiped it gently, because it is the only ear she has to hear with, and this opening of the sinus at present is right at the point

where one might do damage to the hearing. I think that this sinus communicates under a false bottom with the tube, and were it not for its being in such a delicate situation, or if she had hearing on the other side I would not hesitate to reopen it with the hope of getting a dry ear. I feel that all danger was removed from the other ear by operation from a mastoid standpoint, and I do not think she is likely to get up a sinus thrombosis or form granulations in her attic and risk the dangers that accompany an ordinary chronic ear. The ear is just discharging, with a very large perforation in the drum membrane. The discharge is intermittent, and unless it is not taken care of at all it never has any odor and seems to come from the tube.

DR. WHITING: Is the eustachian tube left open on the left side?

DR. PAGE: I suppose so. I have not inflated that ear. I may have inflated it some time ago, but I do not recall doing it. This ear has a dead labyrinth.

To get a dry ear there, the radical operation would be necessary and the general opinion seems to be that if a radical operation were performed the dead labyrinth should be opened to avoid lighting up some trouble in it which would not have an exit.

Dr. Kerrison, I know, has had two experiences, or one experience like that, one fatal, and the other refused to heal, and I think he spoke of more than one case, if I recall correctly, that looked apparently all right, but just would not heal and did not heal until a labyrinth operation was done.

That is the second case. I simply brought her here because the charitable organization has been bothering me to death, calling me up to know when I am going to operate and what I am going to do.

DR. KERRISON: How much hearing has she in the radical ear?

DR. PAGE: Enough to get along with. When she has a little moisture in that ear, she hears better, but sometimes that radical ear will discharge pus very profusely, and then after treatment for a few days it will stop. When you send her home she will come back in about six weeks with excoriated canals and in a very unhappy state.

Double Mastoid Abscess.

DR. PAGE: As to the other case, the man himself wrote this history out for me.

"On August 22nd I went bathing at Rockaway. On the 30th came to clinic with slight pain in left ear. Dr. Page gave me pills for my cold."

He had a very bad cold. I looked at his ears and the drum membranes were slightly inflamed. I gave him a little phenacetin and some bicarbonate of soda, because his head was all congested and his ear drums looked just slightly reddened, not bulging, and he said that they felt better that day than they had the day before, so I thought they were resolving. I saw him a couple of days after that and watched him for some time, and several others in the clinic watched him, and did not think a myringotomy was necessary. He had no pain at all.

The remainder of his report reads as follows:

"September 30th. Had slight pains in right ear and Dr. Page had it opened. No pains in left ear, but ears felt heavy."

Dr. Friesner has seen this man, as a private patient afterwards.

"On October 15th, heavy discharge from right ear and Dr. Page gave me drops. No pains, but ears felt heavy.

"November 1st, left ear opened itself and had very slight discharge from both ears. No pains; ears felt heavy and had constant pulse beat in head with noise."

Dr. Berens, you saw this case also. You advised having a mastoid done on it.

"November 12th. Had blood test (Wassermann) made on advice of Dr. Friesner, which proved negative. No discharge from both ears; ears felt heavy; constant pulse beat and noise in head, but no pains.

"November 22nd. Dr. Page told me to go under an operation. No discharge from both ears; pulse beat and noise in head. No pains.

"December 2nd. Dr. Page operated on both ears. No pains prior to operation."

He had a slight watery discharge that would get purulent when he did not wipe it out. When he kept it clean, there was nothing more than a little glairy discharge from one ear,

and the cultures from the canal showed staphylococcus. There was so much doubt about the condition of the mastoids when they were operated on, that from the very first cell opened cultures were taken, and when we got down to the antrum cultures were taken. The reports from the laboratory were so contradictory that they were of no value.

DR. FRIESNER: What did they get from that antrum that contained pus?

DR. PAGE: I have forgotten. There was pure staphylococcus in one tube and pure streptococcus in another, and in the other cell right next to it some entirely different organism, so the report seemed to me of no value.

The mastoid was apparently filled with pale granulations, like a pink raspberry, with some pus in them, some thin pus.

He has almost exactly the same appearance in his ear drums now that he had before we operated on him.

DR. DENCH: The ears are dried now?

DR. PAGE: No, they dried for a while, as long as his mastoids were open. He has thickened, moist, boggy membranes.

DISCUSSION.

DR. DENCH: It seems to me that all those cases can be dealt with on general principles. What I mean is—I don't wish to be pedantic or anything of that kind, but if I have an ear that is discharging and a sinus behind the ear and in the ear, in the first place I find out whether the sinuses are communicating. I think that can be done very easily by injecting fluid.

In the case of the second young woman—that is, a radical operation on one side and totally deaf on the other; the posterior tympanic space has not been obliterated and the hypotympanic space has not been obliterated as the result of the operation, although there are a certain number of cases where we have a peculiar position of the bulb and a very large posterior tympanic recess, and there I can conceive where those two would communicate directly over the bulb cells. I know what I would do. I would reoperate the case and take away the floor, drawing the hypotympanic space—which will not injure the hearing.

On the other side, it is very difficult to know what happened at the time of the myringotomy. The dead labyrinth brings

us to the point where I know I shall elicit a storm of discussion, and that is on the necessity of removing every dead labyrinth. I have operated on a good many cases, doing a radical operation where there had been no acute symptoms, where the labyrinth had been dead and quiescent, and I never have had a bad result. So that I should not be afraid, personally, to do a radical operation on that ear. I do not believe that the German rule holds there. I mean, I have disproved it so many times. Those rules, you must remember, were made about ten years ago, before we had much experience with cases of dead labyrinth.

With reference to the young man, there seems to me to be a very simple case of the boy who has had a double mastoidectomy and still has discharging ears—and there I would operate again. The tips have not been removed down to the digastric muscles.

DR. PAGE: I can prove that I did it.

DR. DENCH: Then I should be inclined to think that there is a double layer of cells there. There is occasionally found a distinct deep layer of cells beneath the digastric muscle—a second layer of mastoid cells developed very low down. But from the mere fact that he has had a discharge following a mastoid operation after acute otitis another operation should be performed.

DR. BERENS: In the case of the boy, I am inclined to take issue with Dr. Dench on the advice to reoperate upon those two ears; they are still wet, and I believe that if Dr. Page will enlarge the openings very freely in the drum membranes and get busy with the cleansing of the two, and of the tympanum, he will have a very good chance of drying the ears without reoperating. Failing in that, he will have to reoperate. But I should carry that treatment on just as carefully as though I had an operation. In other words, I should see that boy every day for ten days or two weeks, with appropriate treatment.

DR. PHILLIPS: Dr. Friesner, you saw that young man before he was operated—perhaps you can throw some light on that case.

DR. FRIESNER: I think Dr. Page will himself say that these drums have been incised freely. I have no definite ideas with

regard to the etiology of this case, except that it seems to me that there must be some dyscrasia in a case of this kind. When the man first came to me I had a Wassermann done. He had been under treatment then, I believe, for two months. These ears seemed to prove the statement that has often been made, that some ears are chronic suppurating ears from the very beginning. To reoperate upon this ear—that is, to do another simple mastoid as if it were a secondary mastoiditis, I believe would yield no result whatever.

Whatever the trouble is in these ears, it is in the ear—that is, in the tympanum, probably in the tube. I do not believe there is anything behind the ear in the mastoid that would account for the continuance of the condition which you see in the ear. I saw both mastoids open. The right mastoid, I think, was probably as normal as you ever see with a discharging ear. Macroscopically, there was no pus whatever. There was some softened bone in the region of the antrum, but I do not believe there is ever an acute suppurative process in an ear, for any considerable time, without such a bony change around the antrum.

In the other ear, the greater part of the mastoid was, to my mind, perfectly normal, or again I might say as normal as you ever see with an acute otitis. In that antrum, however, there was some pus. Elsewhere in the mastoid I think the structure was practically normal, and I cannot believe, from what I saw at the operation, that there is anything left in those mastoids which would in any way account for the persistence of the condition in the ear.

DR. DWYER: These ears put me very much in mind of a condition we are getting in the nose, where it is essentially a disease of the bone itself, just as Dr. Friesner said, and I think it is a dyscrasia in both these cases, probably tubercular or syphilitic. We can get a weak positive or a negative sometimes without a provocative reaction. In a good many of these cases we do not diagnose them as sinusitis. I would suggest in this case that a subcutaneous tuberculin test be done, and if that is negative, to go ahead.

DR. PHILLIPS: The Chair would like to state that, in his opinion, from a cursory examination of the drum membranes of this young man that Dr. Page has presented, it is not an

ordinary case of chronic suppuration of the middle ear. It is his belief that there is an underlying dyscrasia in this case, probably syphilis, and that the disease is located in the middle ear, probably in its entirety. Another proof of the opinion is that it is not the ordinary appearance of a chronic suppurative middle ear process. The drums are not the kind that we usually observe. They are not the same kind of perforations; there is all the evidence of infiltration and bogginess that you do not get with ordinary chronic suppuration in the middle ear.

Regarding the second young woman, who has a dead labyrinth and a hearing oppostie ear, with a posterior discharging sinus, it seems to the Chair that there can be no successful argument that does not favor the reopening of that ear posteriorly and clearing out the diseased bone. He agrees with Dr. Dench that it can be done without any danger to the remaining hearing function in that ear, and that it ought to be done.

DR. DENCH: I would simply like to modify a remark I made about the young man. When I said reoperate, I did not necessarily mean to do a simple mastoid. After I got in there, if I found the condition that I would expect to find, I would do a radical. The drums suggest this to me, especialy the left one on the side on which he had a furuncle—the right drum has an indrawn cicatrix with a very small perforation near the periphery, and that is a pretty good sign of chronic suppuration.

It was suggested by some of the men that the history may be wrong; that this boy may have had suppuration before, and I think that is possible. In other words, I have yet to see an ear successfully operated on by the radical operation that will not stop discharging, excepting from the tube. We do find a certain number of those where we do have big tubal cells that cannot be possibly cleaned up. I cleaned one up with bone graft, sticking a fragment of bone directly in the tube and plugging it in there. The graft took, and the boy got well.

DR. FRIESNER: I just want to make this suggestion. It occurs to me that a very potent argument against either syphilis or tuberculosis in these ears is the excellence of the hearing.

DR. PAGE: I would just like to say in that first case, just to explain my hesitancy in reoperating on the radical that Dr.

Fowler did, I had an unfortunate experience once in doing a second radical on a man who had a dead ear on the opposite side that had been operated on by Dr. Duel. I operated on the second ear, and following the operation, during the night, the man came out of his anesthetic and asked for a drink of water and replied to the nurse talking to him. Suddenly during the night he said an explosion took place in his ear, and he never heard any more. Now this girl is entirely dependent for hearing on that right ear. If the necrosis is in those cells that lie beneath the facial nerve, that run back under the facial nerve to the tip, where that sinus is, and there is a false bottom that runs also from the sinus that presents itself between the oval window and the round window—it is not more than two millimeters from the oval window—I do not know how much the necrosis extends down or towards the round window. A false bottom can be felt that runs in the hypotympanic space towards the tube, and it is simply because her hearing is dependent on this ear that I hesitate to do what I would unhesitatingly do in any other case. That is a point worth considering, even in regard to the injection of strong antiseptics from behind, or forward, as has been suggested, because I do not know how far the necrosis has extended, how thin the wall of her vestibule is at that point. Now, you may say that if I let it alone it will end in deafness. That is why I brought the case here—to get the opinion of you gentlemen. I, personally, have felt a responsibility about entering the ear in this particular case which I would not feel to the same extent in any other radical.

In regard to her left ear, the discharge is a glairy fluid that comes from her tube. The diseased bone in her attic was pretty thoroughly removed, I think, because I had it so wide open that I could demonstrate the fact that she had no incus. The granulations that were there in that region have subsided, have shriveled up, and there now is to be seen a large perforation in her drum membrane, with no discharge apparently coming from the region of the antrum or attic, but a discharge that comes from the tube. I think that can be demonstrated.

I would like to poll the jury here and see what each man says about going into the radical on the right side, when they realize the location of that sinus—I am not thinking so much

about the facial, because I think it can be guarded against, but her hearing in that ear now is such that she can get along without it, and there are lots of radicals that have not as good hearing as she has, where the hearing is a great deal worse after a thorough radical, and grows worse with time.

In regard to this boy, the trouble originated from bathing in salt water last August. He came in to see me, and his ears looked slightly reddened and they felt a little full. He said they felt better that day than they had the previous day, but they still felt a little full. There was no appearance to warrant any incision of the drum membranes at that time. This boy has never at any time run any temperature, he has never at any time complained of pain, except once I believe he said he had a little pain the first night that his ears felt full after bathing, slight discomfort, but he never has been kept awake at night with an earache. It was weeks before even a myringotomy was decided on, and that was not only on my decision but it was decided upon by other men in the clinic. Dr. Duel saw him several times; I inflated his ears to see if I could not make him feel a little better. He said they felt a little better after that was done. Now, that opening in the right ear, that Dr. Dench refers to, was where a myringotomy was performed. It is the upper end of the incision. There is a small anterior perforation that has come since then.

DR. WHITING: When you made your incision through the tympanic membrane, what was the condition that you found?

DR. PAGE: A boggy membrane. For a week after those incisions were made, the mucous membrane so pouted out through the incisions that it looked as though a polyp the size of a match had appeared.

DR. WHITING: Was there a clearly demonstrable tympanic space there, when you made the incision, or was there a pad of granulations underneath the membrane?

DR. PAGE: I remember going into a boggy drum; I do not remember the feel of the membrane at this time. I do not recall going in to touch the promontory. I do not recall anything more than cutting through a very boggy drum.

DR. WHITING: It did not open and leave a very demonstrable deep space below it?

DR. PAGE: No, you could not see the opening afterwards. As I say, it seemed to increase the inflammation there, the membrane pouted. There was an appearance of the pouting there that resembled a small polyp.

I would like to ask Dr. Whiting what he thinks about the radical on the girl?

DR. WHITING: Of course, I think it is an unfortunate thing that a suppuration should be allowed to go on, with a fistulous path leading out upon the mastoid, but I can thoroughly sympathize with Dr. Page in his hesitancy to accept the responsibility of operating on that girl. She belongs in the working class; her whole future depends on her ability to maintain herself; she cannot do it at all if she loses her hearing, and if by any possible chance as the result of the operation there should be a further loss of her hearing, the girl is facing an absolute calamity, and I would feel very reluctant to perform an operation on her if it was my case.

DR. BACON: Mr. Chairman, I am sorry that I did not have my proper glasses on so I could not really examine the case, but I must say that if it were my ear, that I should be inclined to wait, just as Dr. Whiting has suggested. I think her hearing certainly is of importance to her, and I shouldn't like to operate on it myself, and I should be inclined to leave it alone for the present.

DR. KERRISON: I cannot avoid being influenced in my opinion of this case by trying to place myself in the position of this patient. If there were a bilateral lesion in my own head, with absolute deafness in one ear, even if it were proved to me that the lesion in the hearing ear involved considerable risks to life, I would hesitate to submit to operation, if this operation placed what remained to me of hearing in grave jeopardy. I would not, therefore, operate on this patient.

DR. DWYER: I agree with most of the speakers.

DR. BLODGETT: Dr. Whiting expressed my opinion.

Cholesteatoma Membrane.

DR. FRIESNER: This specimen is a cholesteatoma membrane that I took off the sinus and cerebellar dura of the patient in a case that was operated upon two months ago. I have the skiagraph here. This young man came to Dr. Phillips' clinic,

to the Manhattan Eye and Ear Hospital, and diagnosis of furunculosis was made. The cortex was so thin that it was readily removed with a curette. The cholesteatoma had perforated the cortex in two places, one far back near the knee of the sinus, and the other through the posterior canal wall. At the operation it occurred to me that had I made very firm pressure on that boy's mastoid, I might have stuck my finger into the mastoid. I never thought that such a thing occurred, but Dr. Whiting told me tonight that he had had that experience. The cholesteatoma was about as large as a fair sized chicken egg. This matrix of the membrane was taken from the cerebellar dura and sinus, and the dura and sinus were covered with peculiar gray granulations. The curious part of the case is the fact that when I first saw him he had agonizing pain in his head, utterly unlike any patient with a furuncle, but just exactly like a case with an intracranial complication. These peculiar granulations over the cerebellar dura and sinus have persisted even until today, and I think it must be two months since I operated upon him. Because there was no return to anything like a normal, healthy condition, I have never done a plastic, but the postauricular wound has healed despite that fact.

I do not know just what to do now. I am rather afraid to reopen it, because of this large exposure, and I am a little afraid to leave it alone because of the possible stenosis of the canal. His middle ear looks good—that is, the radical cavity in the middle ear—it is fairly dry. So I am still watching it. I was unable to make out any evidence of intracranial complication—that is, any evidence of a brain abscess. He no longer has any pain. There were no fundus changes and no paresis and no ataxia, everything is apparently normal and his labyrinth has fair hearing on that side. I have seen larger cholesteatoma erode through the posterior canal, where a radical had been done by a cholesteatoma, but I never saw so large a cholesteatoma confined to the mastoid alone.

Dr. Friesner exhibited a radiograph of this case.

DR. WHITING: Mr. President, I once had a case which was as nearly analogous to what the doctor described, at least as to my understanding as to what he has described, as two cases often are, and it was in a young girl who had had chronic sup-

puration for eighteen years. She was a young woman twenty-three or twenty-four, and when I removed the cholesteatomatous mass and took out this great capsule, the sinus was exposed, the dura of the middle fossa was exposed, and both were covered with granulation. I do not recollect that the granulations were of the necrotic character which he has described, but there was a mass of granulation there. What I did was to make the usual incision, as we do for a radical mastoid, turned up a flap from below the tip, turned it in on the edges of the wound just inside the border of the bone opening, so as to establish a big permanent posterior opening there. I split the posterior canal of the fibrocartilaginous meatus, turned it up and down, making a sort of a T-flap, and let the cavity epidermatize from the bottom. I see her once in a year or two. She has never had the slightest disturbance of any kind since; she has no middle ear. Her middle ear corresponds to some extent to the deeply retracted scar that one of these cases we have looked at tonight had on the left side. I did not put a graft over it. I simply turned up this flap so as to prevent the wound from healing externally and that gradually epidermatized, and the young woman has never had any trouble.

I should think the doctor could do the same thing: open the wound wide, let what corresponds to your opening be a great big deep scar that goes right down into the tympanum. I believe it would heal.

DR. FRIESNER: The case after operation was left in charge of the house doctors, and of course they thought they were getting a wonderfully good result by this postauricular healing; they thought that was the thing to be desired. I think the same result that Dr. Whiting speaks of might have been obtained by persistent packing leading down to the middle ear, so that this opening gradually would have epidermatized.

Presentation of Instrument.

DR. PAGE: I have a little instrument here. Dr. Eagleton's device suggested this to me. With his instrument he had to put a suture, as I understand it, through the dura, under the sinus, to control hemorrhage from that vessel. I have never

tried this on a living subject, but it seems to hold pretty well on the cadaver.

This is just a thing I have made up myself and used on the cadaver. This can be put under one edge of the bone and then, pressing down like this, will hold your sinus. The advantage of this, if I might demonstrate it to you for a moment, is that it holds and is not dependent on any assistant to hold it for you.

DR. WHITING: I have at the New York Eye and Ear Infirmary two devices similar to the devices that Dr. Page has, and they have failed me twice, and I have never had the nerve to use them since. In neither of the two cases in which I tried it, did it work perfectly, and I went back to my gauze pad under the bone. Those instruments are down there, they have been there for eight years, and they are very little different from the instrument you have shown here tonight. They did not answer the purpose. Possibly if I had tried them a considerable number of times and become more adept or skillful in the application of them, they might have worked; I always thought they should work, but they did not work in the few cases I tried, and I did not have the persistency to keep at it.

Sarcoma of the Mastoid.

DR. DWYER: I ran into a case in our clinic with Dr. Steele that I have never seen before. There was a young boy five years old admitted with all the symptoms of mastoid abscess, and he was operated on, and when Dr. Steele got down in there he found a mass of granulation tissue in the depths of the mastoid itself, which we diagnosticated immediately as sarcoma. On further examination he was found to have a globular mass up in the nasopharynx. The disease came on the second week in December. In less than a month he developed a partial facial paralysis. Before he came to the hospital, the family physician had been picking pieces of bone out of the middle ear. The astonishing thing to me was, I have never seen a sarcoma in the nasopharynx. I do not know whether it started in the nasopharynx and worked through the middle ear or not. It has destroyed all the bony structures of the middle ear, with dura exposed above, and with practically the

main mass in the nasopharynx, but still in the middle ear, with the posterior wall broken down.

DR. DENCH: I saw one case of an infant a good many years ago, and in that case it started in the middle ear, spread down through the eustachian tube and spread down into the nasopharynx. We opened the mastoid, believing that we were dealing with a case of suppuration. The mastoid refused to heal. There was persistent discharge from the ear, and I then had an examination made of a portion of the tissue in the mastoid wound and found that it was sarcoma.

DR. BACON: I reported a case many years ago of sarcoma which likewise started in the middle ear. I was very much impressed with one symptom which persisted from the very start, viz., pain of a most excruciating nature. The patient soon developed facial paralysis. I opened the mastoid cells, and found the case to be one of sarcoma of the temporal bone. The patient died.

DR. WHITING: I also had a case similar to the one Drs. Dench and Dwyer have described. It was a case of sarcoma. It started in the middle ear, went down through the eustachian tube and involved the tonsil. It was in the case of Dr. Herman Knapp, and he asked me to see it; he said he did not care to take the case and sent it over to the New York Eye and Ear Infirmary. The man suddenly jumped a high temperature, with a chill, up to 105 or 106, and repeated that three or four days. I made a diagnosis of sinus thrombosis, opened his mastoid, and he had the whole of the sinus plugged with a fibrinoplastic clot. It had not undergone disintegration. We cleaned out the sinus for him, but did not do a jugular resection. The man made a perfect recovery from his sinus condition and lived about two years and died from sarcoma of the brain.

DR. DWYER: We have run into two cases lately of tuberculosis of the mastoid, one of them from Dr. MacKenty and Dr. Friesner, where we simply took the scrapings from the mastoid at the time of operation and we demonstrated tuberculosis in those mastoids. The other one was one that we demonstrated in the same way. So that in the children it seems we are picking up these cases much quicker than we used to.

DR. PHILLIPS: I feel that this contribution to the literature of the subject, made through the efforts of the Pathological Department of the Manhattan Eye and Ear Hospital, and the cases which were worked up some two or three years ago, and a rather large number were reported—several from my own service—of tuberculosis as a cause or accompaniment of chronic suppuration of the middle ear, especially in children, ought to take their place in the literature of otology. It is certainly more prevalent than most of us have thought.

Adenoids and Protrusion of the Tongue.

DR. KERRISON: I would like to mention a case which is causing me some anxiety. It is that of a baby 10 months old, which was sent to me for removal of adenoids. In general physique, it has the appearance of a well-nourished infant of good average development. The peculiar feature is that the tongue protrudes well out of the mouth. This is a habitual and practically constant condition and has persisted almost from birth. The nose is very undeveloped. One can of course feel the little nasal bones, but below their lower margin the nose is very flat. The nasal cavities are very small. I could not determine that the tongue is of unusual size, but it is unusually resistent to the tongue depressor. The tonsils are fairly large, and the nasopharynx, which is small, even for a baby of 10 months, contains a considerable mass of adenoids. I have agreed to remove the adenoids and tonsils, and am wondering what, if any, risks I am assuming attributable to the condition I have described. I should be glad to have an expression of opinion.

DR. DENCH: Is there much apparent vascularity at the base of the tongue?

DR. KERRISON: No.

DR. DENCH: I don't see any harm in taking them out then.

DR. KERRISON: I was wondering whether, following removal of tonsils and adenoids, the excessive type of mouth-breathing and the abnormal position of the tongue would be likely to give rise to inflammation of sufficient severity to constitute a dangerous condition.

DR. DENCH: I would do it in one, unless I found a great deal of vascularity at the base of the tongue, on account of

hemorrhage. Failing that, I should treat it as an ordinary case.

DR. PAGE: I operated on a case somewhat similar to that on a rather small baby that had a protruding tongue, it was a true macroglossia in a child that was not well developed mentally, and I had no difficulty in removing the adenoids. I didn't hear anything more from it for about a year, and I happened to inquire and learned that the child died from its poor development, probably a year or so afterwards; it got pneumonia, as they usually do.

DR. BACON: It seems to me I would be a little more conservative in such a case as that. I should be inclined to do the operation at two sittings. In a child so young I should want to remove the adenoids first and see the result of the operation before removing the tonsils.

Chronic Suppurative Otitis and the Radical Operation.

DR. BLODGETT: I had two rather unusual cases, I mean unusual in the way I was turned down. I didn't imagine here in New York that a family physician would so express himself. They were both O. M. P. C. One was a girl of fourteen, with a profuse purulent discharge. She came to me simply because she complained that when she warmed up under exercise, especially in dancing in the evening, there was an overflow on the side of her face of a purulent discharge from the ear. The other was a woman of fifty-five, scrofulous habit, good health apparently, only with a profuse purulent discharge from the ear. I said a radical operation would be a very good thing and the family doctor turned me down in each case. In the first case he said that the young lady was no worse now than she had been for the last eight years; that she was only fourteen and he imagined that in the next year or two she would become developed and that would have a great deal to do with the discharge. In the other case the woman had had the purulent discharge for a great number of years and it was equally profuse so that it ran down the outside of the face. The doctor said this was a scrofulous family, and if any operation was done on the ear with the idea of healing the purulent discharge from the ear, it would be very apt to affect the lungs, and he objected to the operation. I didn't think his objections had any standing whatever, but it brought up in my mind the question,

given an O. M. P. C., with no prominent signs of extension or prominent localizing symptoms and yet are we not warranted in doing the radical, or in an O. M. P. A. with mastoiditis, where the constitutional signs of septic absorption were slight, yet were not warranted in doing a mastoid operation. I could not see any reason why in either one of those cases operative intervention was not indicated.

DR. PHILLIPS: I would like to know whether the family did not sustain the position of the physician?

DR. BLODGETT: The lady said she was not going to have anything done until it caused her more trouble.

DR. PHILLIPS: These are everyday experiences. These two cases with the accompanying hints are open to you for discussion.

It brings up the question of educating the family physician, to a considerable degree. I think the knowledge of the family physician today, compared with his knowledge fifteen years ago regarding the ears, has improved very materially. One evidence of it is that in the clinics we no longer see chronic ears or acute ears with the entire external auditory canal packed solid with boracic acid, as we did years ago, and the family physician today is much more prompt in calling for aid in the treatment of an acute ear. There are a number of conditions where the general attitude of the profession has changed, but it does not so appear regarding chronic suppurations.

DR. BLODGETT: They seemed to be waiting for some focal conditions or symptoms, some threatening conditions, something that the person has not had, before they will take the advice of the otologist.

DR. DENCH: My own experience is that the family physician is more alarmed by acute mastoid symptoms than the man who has had experience in treating ears. I think that the otologists have to be careful to see that every tender ear that needs operation is operated upon, but not every tender ear is operated upon. However, I am afraid that a good many men, either from stress of hospital work or from imperfect examination, sometimes have been responsible for some of this undue enthusiasm on the part of the general practitioner regarding acute cases. It is very much like the operation for acute appendicitis, when the operation was first advised. However, the profession has now settled down into a very sane and safe

method of dealing with acute appendicitis, and I think as a rule we have with an acute mastoiditis, but I think occasionally we are beguiled into going into a mastoid, where draining of the middle ear for a little time would have obviated the necessity for the mastoid operation.

DR. KERRISON: I just wanted to suggest that Dr. Blodgett get this particular doctor to come around to the Otological Society.

DR. BLODGETT: I think the general practitioner is alive to the acute cases, but in the chronic cases we can still do some missionary work.

DR. PHILLIPS: Perhaps it can be well expressed in this way, when there is necrosis of the shaft of one of the long bones, or the hip joint, or spine, or any other part of the body, there isn't one general practitioner in a hundred who wouldn't have that case submitted to the knife without delay, but here we have necrosis in the temporal bone, more serious than the types above mentioned, but it is permitted to continue because it is called a discharging ear instead of necrosis of the temporal bone.

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